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DOBSON & BARLOW LTD.,

BOLTON,

MAKERS AND PATENTEES

OF

MACHINERY

FOR

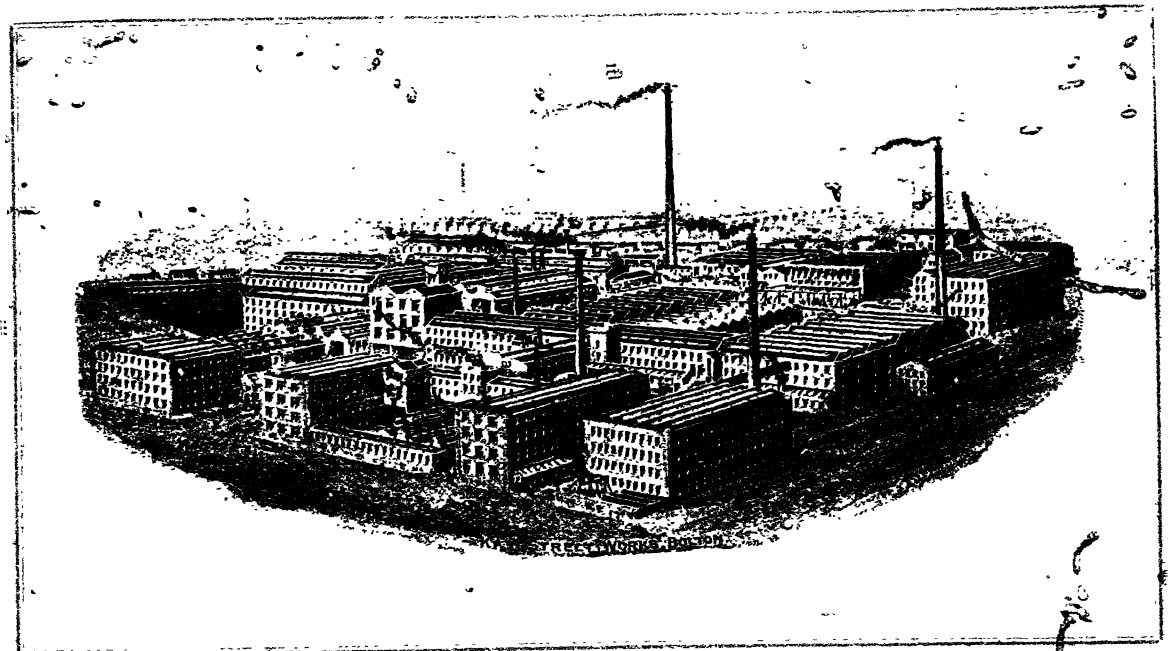
PREPARING, SPINNING, DOUBLING, WINDING,

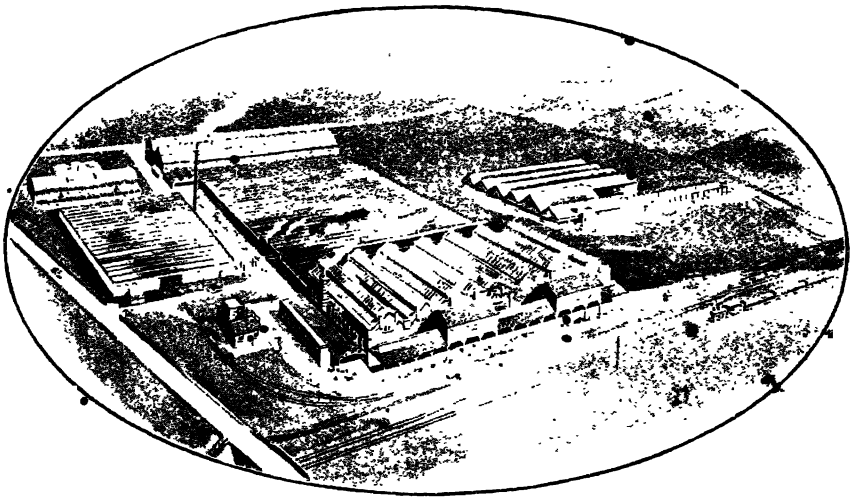
REELING AND GASSING COTTON;

ALSO OF MACHINERY FOR

WOOL, WORSTED, SILK, AND WASTE YARNS.

1922.





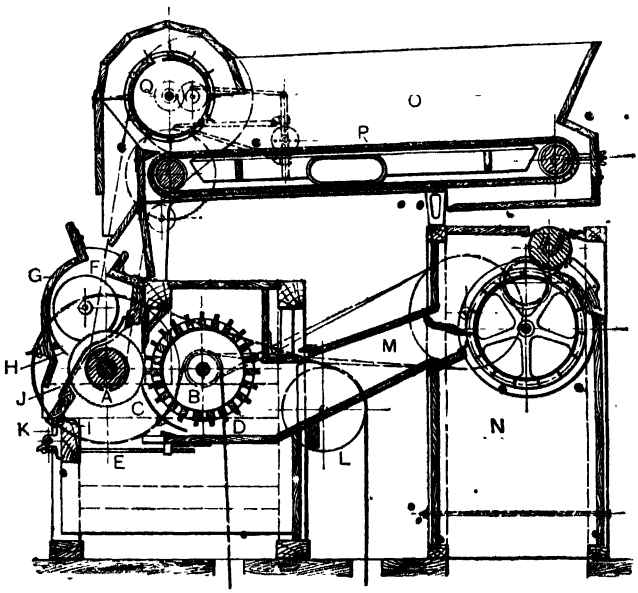
BRADLEY FOUNDRY WORKS

INTRODUCTION.

IN compiling and presenting this small work, we have kept specially in view its utility to Managers, Carding and Spinning Overlookers, as well as others associated with Cotton Spinning. There are many such who often feel the need of a small handy book of calculations, tables and general information connected with the working of cotton and the machinery required in the preparation and spinning of same. We sincerely trust that the book will answer this purpose, and will meet with the same appreciation our previous efforts have obtained.

BOLTON, January, 1922.

INDEX.



SECTION OF SAW GIN WITH 70 SAWS,
SHEWING FEEDER AND CONDENSER ATTACHED.

SAW GIN.

REFERENCES TO SECTION OF SAW GIN, FEEDER AND CONDENSER.

A Saws.
B Brush.
C Brush guard.
D Mote board
E Mote board adjusting screw.
F Seed cotton roll chamber.
G Curved seed board.
H Adjustable seed cleaning tooth plate.
I Set screw supporting grate bars.
J Grate bars.
K Lever for raising grate bar.
L Driving tension pulley.
M Lint flue.
N Condenser.
O Feeder hopper.
P ,, lattice.
Q ,, spike roller

NOTES.

FOR SAW GIN WITH FEEDER AND CONDENSER ATTACHED

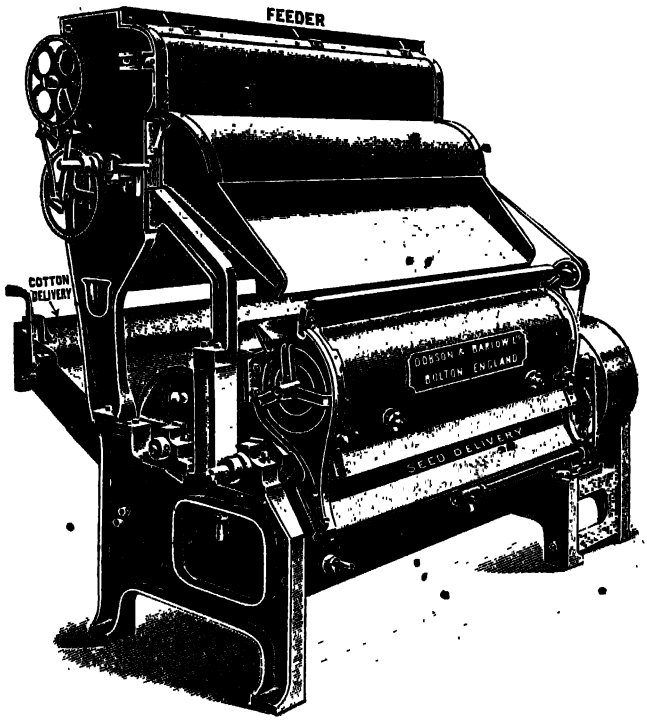
Power.—1 m.h.p. for 10 saws.

Production.—Up to 450 lbs. of cleaned cotton per 10 hours for every 10 saws, according to variety of cotton and the speed of gin.

Speed of Saws.—350 to 400 revs. per minute.

Driving pulley.—From 12 in to 19 in. diameter, according to size of gin.

Floor space.—Gin with 70 saws, 7 ft, 0 in. × 6 ft. 0 in.
,, ,, 20 ,, 6 ft. 3 in. × 3 ft. 6 in.



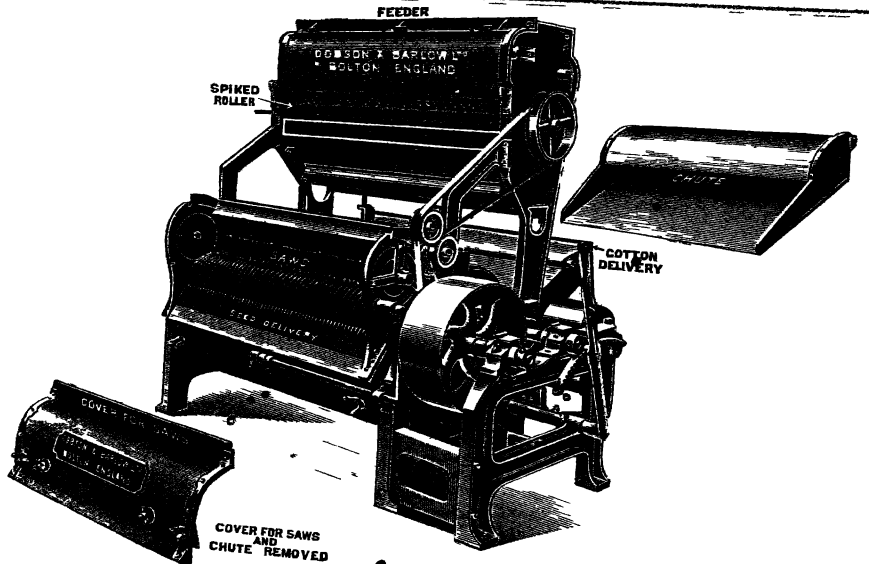
IRON SAW GIN WITH 70 SAWS FOR SUCTION FEED,
FRONT VIEW.

SAW GIN.

This machine is constructed with 20, 30, 40, 50, 60, or 70 saws, the framework being solidly made either of cast iron or of the best selected and well-seasoned ash and birch. Everything is securely bolted together, and the shafts are made from best mild steel, running in self-aligning and self-oiling bearings of ample length, with anti-friction metal linings supplied with brass lubricators.

The saws are 10 in. diameter made from the best steel, and are set separately upon the shafts, being secured with nuts and washers. The machines are well adapted for short staple cotton and have a large productive capacity, the machine of 70 saws being calculated to produce up to 450 lbs. of cleaned cotton per 10 hours for every 10 saws, according to variety of cotton and the speed of the saws, the latter making from 350 to 400 revolutions per minute. When used singly the machines are made entirely self-contained, that is, they are fitted with a lint flue and a condensing apparatus complete.

The machines are driven from a line shaft preferably underneath the gin, which is so arranged with idler pulley that one belt can drive both the saw shaft and the brush shaft, the starting and stopping being controlled by hand lever.



IRON SAW GIN, WITH 70 SAWS, FOR SUCTION FEED,
WITH COVER FOR SAWS AND CHUTE REMOVED.

Saw Gin.

When several machines are required they are usually formed into a battery, and instead of each machine having its own condenser, each machine delivers the cleaned cotton into a trunk, through which it is forced to a single condenser which in turn delivers it to the baling press It is unnecessary to handle the cotton in any shape or form from its being delivered in the waggon from the cotton field to the same being made up into the bale at the baling press The waggon containing the seed cotton is placed under a large pneumatic flue and the ginning is done automatically The suction elevator takes the cotton from the cart or waggon and draws it up to the gins by means of an exhaust fan working at the extreme end of the tube As the cotton is conveyed along this tube it is deposited through sliding doors into each of the gins After passing through the latter the ginned cotton (or lint as it is sometimes called) is blown along the trunk to the condenser from whence it is delivered down a chute to the baling press

Notes

For Saw Gin with Feeder and Condenser attached

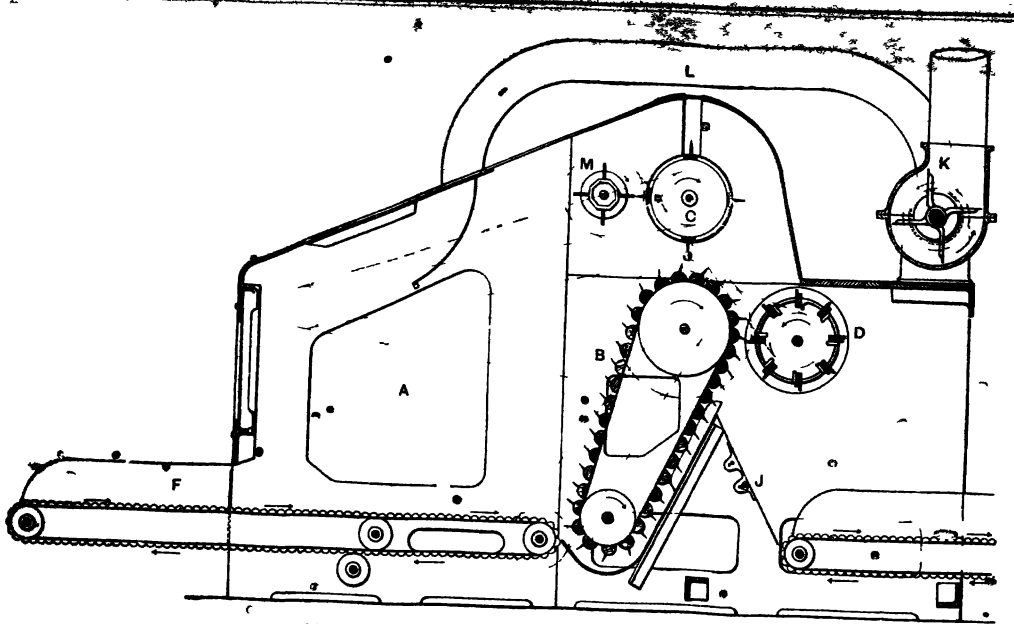
Power —1 m h p for 10 saws

Production — Up to 450 lbs of cleaned cotton per 10 hours for every 10 saws, according to variety of cotton and the speed of gin

Speed of Saws 350 to 400 revs per minute

Driving Pulley —From 12 in to 19 in diameter, according to size of gin

Floor Space — Gin with 70 saws, 7 ft 0 in × 6 ft 0 in
" " 20 " 6 ft 3 in × 3 ft 6 in



SECTION OF HOPPER BALE BREAKER

Hopper Bale Breaker.

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

A Cotton chamber.

B Spiked lattice.

C Improved evener roller

D Stripper roller.

F Feed lattice

J Cotton guide plates

K Dust fan.

L Dust pipe from cotton chamber.

M Evener roller stripper

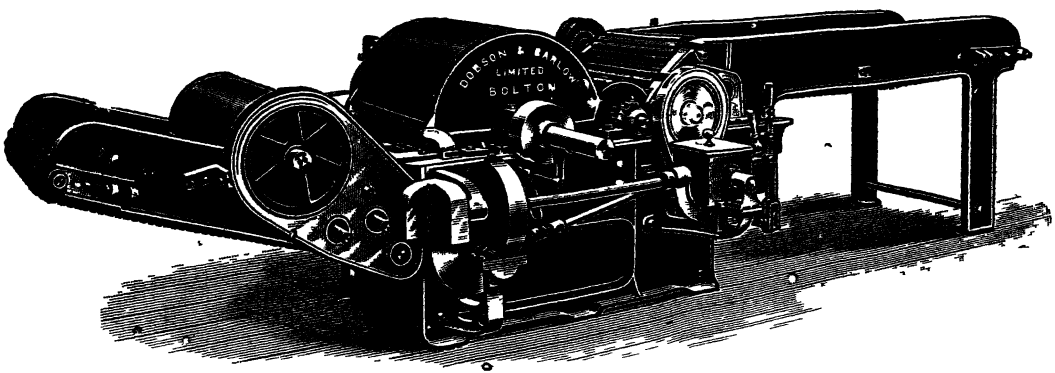
NOTES.

Power.—2 to 2½ n.h.p.

Pulleys and Speeds—16 in × 3 in.; 450 to 500 revs. per minute.

Strapping—Line shaft to machine 30 ft × 3 in; stripper roller to evener roller 10 ft × 1½ in; evener roller to carrier pulley 13 ft × 2½ in

	Floor Space		Approximate Weight.		Approx. Cubic Measurement.
	ft in. ft. in	Metres.	Gross Cwts.	Net Cwts.	Feet.
Breaker, 36in. wide, with Feed Lattice 7ft. oin long ..	11 10 × 5 7	3,61 × 1,71	42½	31½	179
Breaker, 48in. wide, with Feed Lattice 7ft. oin. long ...	11 10 × 6 7	3,61 × 2,00	48½	37	203



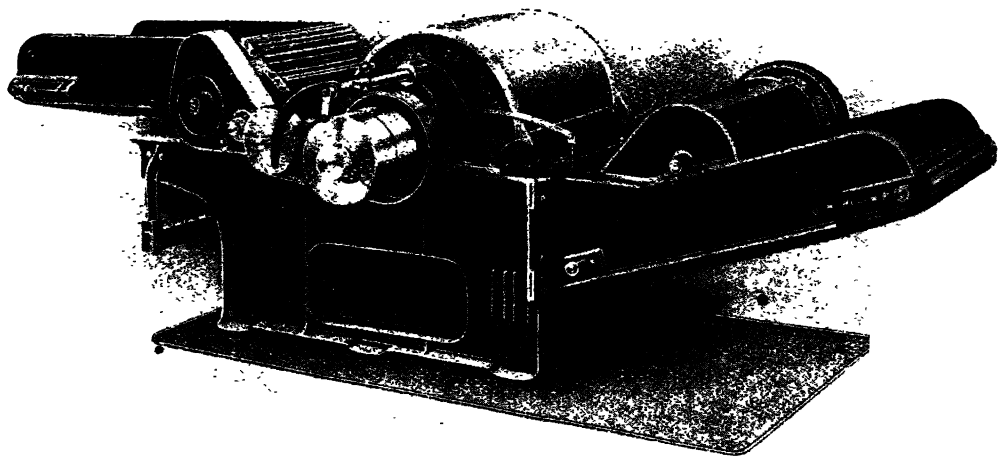
IMPROVED SOFT WASTE OPENER.

IMPROVED SOFT WASTE OPENER.

This machine has been specially designed to open Roving Waste, Slubbing and Intermediate Waste, Roller Laps, etc. It is rigidly built, the patterns having been very carefully designed to embody strength with neatness and accuracy, thus ensuring smooth running at the highest speeds necessary.

It is made 25 in. wide, with lattice feeding apron, and is constructed with pedal feed roller, fluted and chased, with self-weighted pedals. The pedal noses are specially adapted for the licker-in to strike from. Small intermediate cylinder 9¾ in. dia., covered with beech lags containing cylinder 9¾ in. dia., clothed with saw tooth wire; main wrought iron cylinder, 24 in. dia., covered with beech lags containing black-forged cast steel teeth. Delivery end arranged either with cage, to deliver the cotton loosely on to the floor, or to feed into an Exhaust Opener by means of a pipe. In the latter case the machine can have cone feed regulator applied, to give a regular delivery to the Opener.

A reversing motion is applied to the feed to reverse the direction of pedal roller and feed lattice, when necessary. The feed lattice can be made any suitable length from 2 ft. 6 in. to 20 ft. 0 in., as may be required.



IMPROVED SOFT WASTE OPENER.

Improved Soft Waste Opener.

A locking arrangement is applied to the cylinder cover and the hinged plate between cylinder and delivery cage to prevent the opening of the cover during the running of the machine. Perforated steel guard under licker-in.

All gearing well covered, cylinder and licker-in bearings on the self-oiling system with brass bushes. Licker-in shaft thoroughly case-hardened.

NOTES.

Power, 2½ m.h.p.

Speed of cylinder, 800 revs. per minute.

Speed of licker-in, 1,300 „ „

Pulleys on cylinder shaft, 10 in. × 4 in. = 254 mm × 101,6 mm. F. & L.

Pulley on cylinder shaft, 13 in. × 2½ in. = 330,2 mm. × 63,5 mm. to drive licker-in.

Pulley on licker-in shaft, 8 in × 2½ in = 203 2 mm. × 63,5 mm.

Pulley on cylinder shaft to drive feed and delivery end, 9in. × 3in = 228,6 mm. × 76,2 mm.

Production, 100 to 120 lbs per hour = 45 to 55 kgs.

Approximate weights, gross 36 cwts , net 26 cwts.

Approximate cubic measurements, 145 feet.

Strapping required—

Line shaft to machine, 40 ft. 0 in. × 4 in. = 12,20m. × 101,6mm.

Cylinder to licker-in 6 ft. 8 in. × 2½ in. = 2,03 m. 63,5 mm.

Cylinder to side shaft pulley, 6 ft. 7 in. × 1½ in. = 2,00 m. × 38,1 mm.

Space occupied, with 3 ft. 6 in. = 1,06 m. of feed lattice, 10 ft. 10 in. × 5 ft. 7 in. = 3,30 m. × 1,70 m.

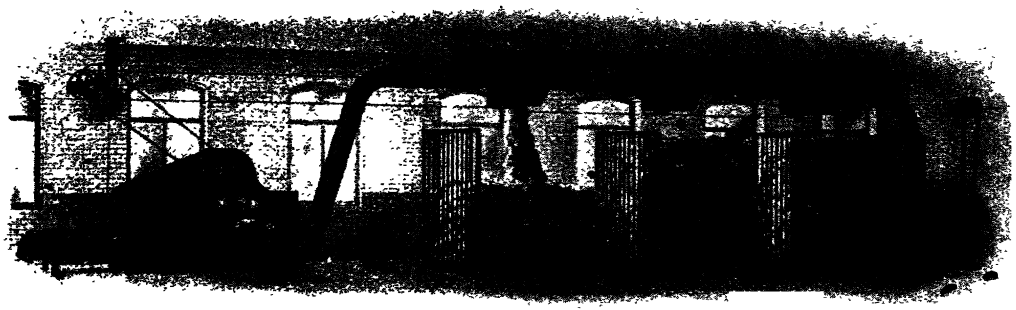


FIG. I —PATENT PNEUMATIC DELIVERY ARRANGEMENT FOR COTTON MIXINGS.

Without doubt the most satisfactory Conveying Arrangement ever produced.

Mixing Room absolutely free from dust ensuring the most Hygienic working conditions. Less Cleaning and Oiling. Economy in Labour and Repairs. Less Waste.

PATENT PNEUMATIC DELIVERY ARRANGEMENT FOR COTTON MIXINGS.

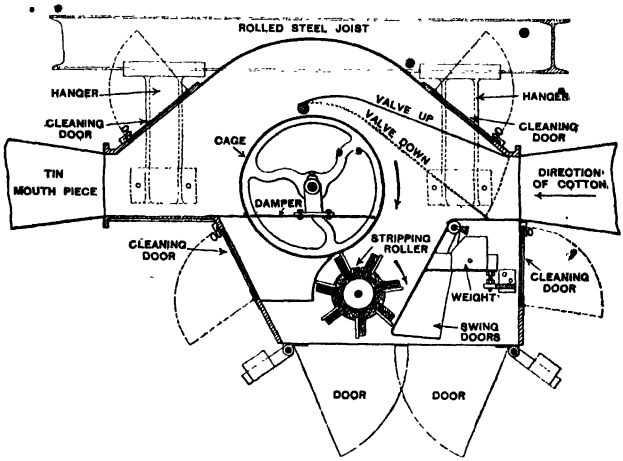
In view of the fact that dust removing installations are being placed in the cardrooms of cotton-spinning mills with great success, and benefit to the operatives, we are bringing before the notice of the cotton-spinning trade a new method of delivering cotton from the bale breaker to the mixing-room in order to dispense with the usual lattice arrangements. In the latter system the bale breaker delivers the opened cotton on to a travelling lattice, from which it is carried automatically to mixing stacks, which can be located on the same floor or below the opening-room as the case may be. If the bale breaker is arranged over the mixing-room, the cotton is dropped through the floor upon a travelling lattice or lattices placed underneath, and by means of the latter delivered to the mixing-stacks. If the bale breaker is arranged on the same level as the mixing-room the cotton is deposited by the machine upon a short horizontal lattice that delivers it to elevating lattices, whence it is placed on to travelling horizontal lattices, which in turn carry the cotton to any desired mixing-stack.

This invention which we have introduced is to supersede the above method of carrying cotton, and to dispense with the use of these lattices. It is termed the Patent Pneumatic Delivery Arrangement, and an illustration showing one of the many possible arrangements is given in Fig. 1. A pipe is employed for conveying the cotton, commencing from the bale breaker and passing through to the mixing-room, over the mixing-stacks, and back to a point near the bale breaker and then into the dust chamber. A delivery box arranged, with a perforated cage, stripping and delivery rollers, is fixed in the piping over each mixing stack, whilst in the mouth of the return piping near the bale breaker a powerful exhaust fan is placed. As the opened cotton leaves the bale breaker it is drawn by the action of the exhaust fan through the piping to the delivery boxes, from which the cotton drops into the various mixing stacks as desired. Arrangements are made for guiding the supply of cotton to any particular mixing, since each delivery box is provided with suitable valve mechanism, which is connected to hand-levers; thus the cotton in the piping can be diverted by the attendant into any required mixing-stack. One of the principal features of the pneumatic system is its great cleansing

properties; for whilst the cotton is being drawn by suction through the piping, it comes into contact with and against the cages in the delivery boxes, giving opportunity for the dust and dirt to be separated and drawn through the cages by suction. The cotton thus freed from impurities falls down into the mixings, whilst the dust and dirt are carried forward through the fan and into the dust chamber; the dust and dirt, therefore, are not only taken out of the cotton, but also out of the mixing-room. The difference in the cleanliness of the latter room over the old system of lattice-work is remarkable. With the lattice system a certain percentage of the dust and dirt is deposited in the mixings, and it is absolutely necessary to be continually cleaning and dusting the lattice sides, bearings, etc., on to which the fluff, etc., has caught The air in the room is also fully charged during working operations with this fluff and dirt, which is very objectionable and unhealthy for the operatives. With the new system, however, a perfectly clean room results, with a clearer atmosphere and better and cleaner mixings; the working conditions of the operatives are also considerably improved and rendered healthier. Another great advantage which the pneumatic system possesses over the travelling-lattice system is that it can take the cotton from any part of the bale-room whether it is built in or apart from the mill, and can deliver the cotton to the mixing-room no matter in what position in the mill the latter may be placed. The system also tends to remove any possible dampness in the cotton, and further, almost all possibility of fire is avoided. The system is giving the greatest satisfaction, and, considering the agitation at the present time for dustless cotton mills, it will no doubt prove interesting to the trade.

Whilst on this question of cotton conveying for blowing-rooms, it might be interesting to learn of a further system for conveying cotton by the pneumatic process from the mixing-room to feed the openers in the scutching-room automatically. The illustration shown in fig. 2 will give a good idea of the system in question. Placed in the mixing-room is a hopper feeder fed from the mixing-stacks by means of a horizontal lattice. This machine delivers the cotton into the piping A, through which it is conveyed to a condenser box B placed in the scutching-room behind the hopper C, attached to the cotton opener. This condenser box is furnished with a perforated steel cage, and

also the necessary fans for drawing the cotton from the hopper D in the mixing-room, along the piping on to the condenser cage; from this latter it is delivered on to the bottom lattice of the hopper feeder C and forward into the cotton opener. The fans in the condenser box serve a double purpose, for in addition to drawing the cotton on to the cages, they create a down draught, and as the action of the cotton coming into contact with the cages frees a



SECTION THROUGH BOX.

large percentage of the dust and dirt contained therein, this objectionable material is drawn through the fans and into the dust cellar below. Suitable mechanism is arranged between the hopper feeder in the mixing-room and the hopper feeder in the scutching-room for the stopping and starting of these machines, whereby a regular supply of cotton is also automatically maintained.

An important feature in the use of this pneumatic feeding system is that it is not absolutely necessary to have the scutching-room placed directly underneath the mixing

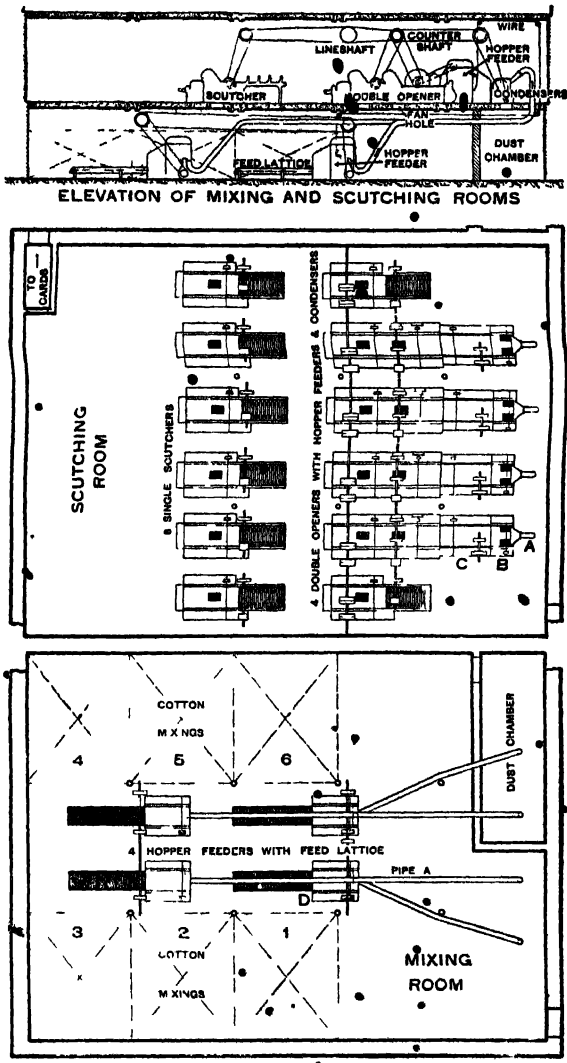
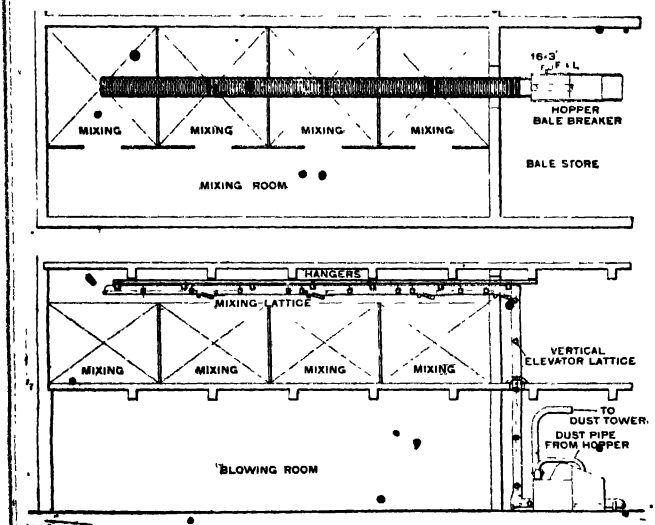

WIRE
LINESHAFT
COUNTER SHAFT
HOPPER FEEDER
SCUTCHER
DOUBLE OPENER
CONDENSERS
FAN HOLE
FEED LATTICE
HOPPER FEEDER
DUST CHAMBER
ELEVATION OF MIXING AND SCUTCHING ROOMS
TO CARDS
SCUTCHING ROOM
8 SINGLE SCUTCHERS
4 DOUBLE OPENERS WITH HOPPER FEEDERS & CONDENSERS
A
B
C
COTTON MIXINGS
4
5
6
DUST CHAMBER
4 HOPPER FEEDERS WITH FEED LATTICE
PIPE A
D
3
2
1
COTTON MIXINGS
MIXING ROOM

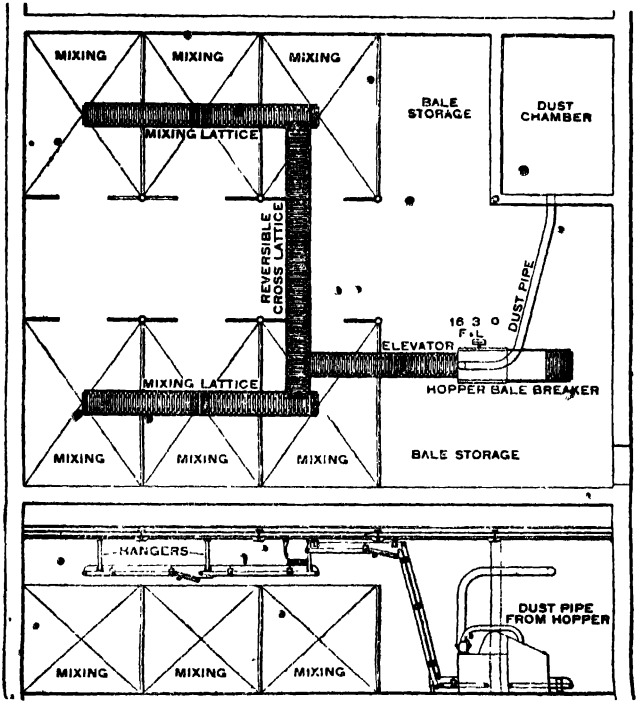
FIG. 2

room, but rather it can be placed above the mixing-room, or in any other convenient position in the mill. The relative position of the scutching room to the mixing-room is immaterial, for the cotton can, it is claimed, be conveyed any reasonable distance, even up to 250 ft., without inconvenience. Another special feature which ought to be mentioned is that the system can be used for the finest cotton as well as the short cottons without being at all detrimental to the cotton either in appearance or otherwise. This is stated to be due to the fact that the cotton is drawn on to the perforated steel cage without being brought into contact with the fans; thus there is not the least tendency to string or curl it, such as is the case in the ordinary exhaust openers of the horizontal or vertical type. The whole arrangement is thoroughly automatic in its working, and so long as the hopper feeder in the mixing-room has its feed lattice charged with cotton no further attention is required.

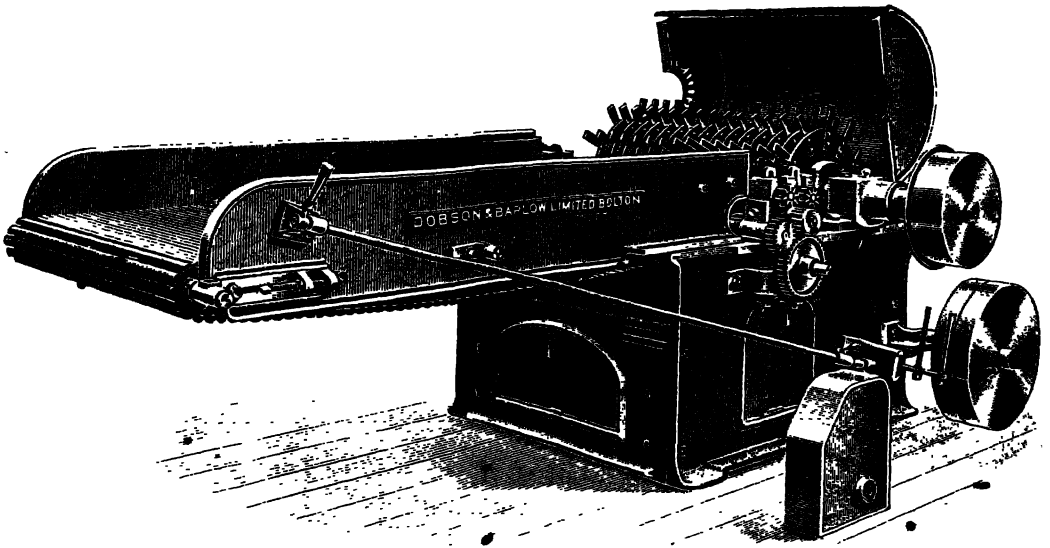
The system provides extra cleaning facilities for the cotton, and although it has not been before the trade for any length of time, the arrangement has been furnished to many new mills, in addition to having displaced the lattice arrangement in several mills with great success The idea in designing and perfecting the above systems was to obtain suitable apparatus whereby the cotton whilst in transit from the bale to the openers could be cleaned without damage to the staple, and tend at the same time to relieve the opening machinery. With the combinations described—viz., the pneumatic delivery arrangement for cotton mixings, worked either alone or in conjunction with the pneumatic system of feeding cotton from the mixing room to the openers—it is claimed that the object has been realised of being able to deliver the cotton to these machines in a more open and clean state than can be obtained by the lattice systems, whilst in addition there is no comparison as regards the arrangements for removing dirt, etc., and for cleanliness and healthier working conditions in the mill. There is no doubt that the removal of a large proportion of the dirt, etc., from the cotton has its effect upon subsequent processes. In this connection it is interesting to note that when stripping the cards the amount of dust created is very small, thus showing the benefit of an early removal of this foreign matter, etc.



PLAN AND ELEVATION OF MIXING LATTICES—
4 MIXINGS.



PLAN AND ELEVATION OF MIXING LATTICES—
6 MIXINGS.



PORCUPINE OPENER.

PORCUPINE OPENER.

This machine is of great service as a feeder in cleaning and opening the cotton before it enters the vertical opener to which it is connected by pipes.

The machine is made 37 in. wide, and is fitted up with a cylinder C, 24 in. diameter, having hard steel knives riveted on to circular plates; also with two pairs of rollers, A and B, weighted with springs.

We also make this machine with cone feed regulator and pedal motion, with link regulating motion, if required, to feed openers which make laps.

The "Simplex" hopper feeder can be applied if desired.

NOTES.

Power.—2 to 2½ m.h.p.

Production.—30,000 to 40,000 lbs. per week.

Pulleys and Speeds.—14 in. × 4½ in., 800 revs. per minute.

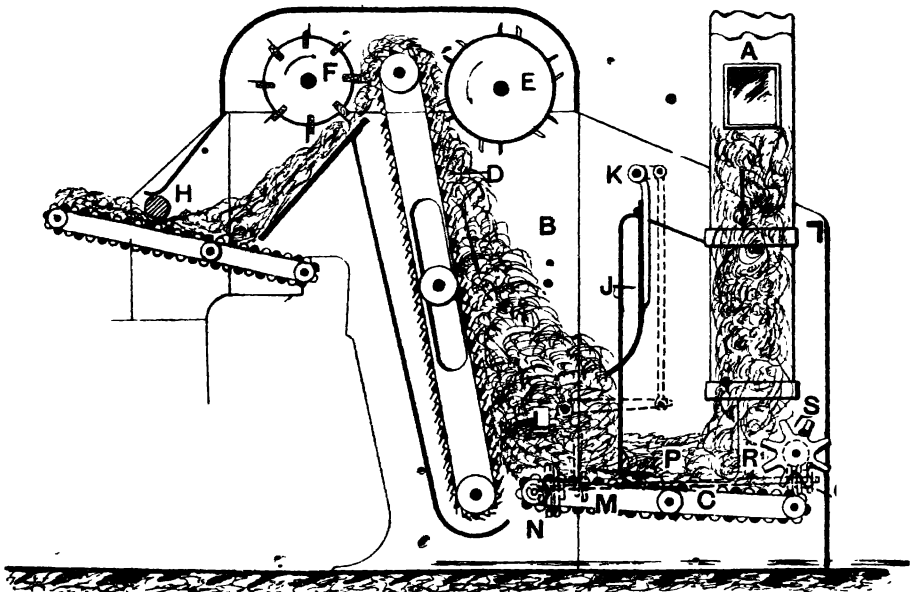
Strapping.—See pages 53 and 54.

Floor Space (with lattice feed 5 ft. 6 in. long).—8 ft. 9 in. × 6 ft. 5 in = 2,66m. × 1,96 m.; add for delivery pipe 2 ft. 0 in., or 0,61 m. to length.

Approximate Weights.—Gross 30 cwts.; net 23 cwts.

Approximate Cubic Measurement.—115 ft.

Feed Lattice.—3 ft. = 0,915 m. wide; length as required.



SECTION OF "SIMPLEX" AUTOMATIC HOPPER FEEDER.

"Simplex" Automatic Hopper Feeder.

REFERENCES TO ILLUSTRATION ON PAGE 26.

A Feed trunk.	K Feeler plate rod.
B Cotton chamber.	L Knocking-off lever pivot.
C Bottom lattice.	M Catch box.
D Upright spiked lattice.	N Bottom lattice driver.
E Patent evener roller.	P Side shaft.
F Stripper roller.	Q Worm.
H Condensing roller.	R Worm wheel.
J Feeler plate.	S Spiked feed roller.

NOTES.

Power.—About 1½ m.h.p.

Pulleys and Speeds.—Stripper roller pulley, 12in.dia. × 2¾in.wide. 225 revs per min.

Evener roller pulley 12in. dia. × 2¾in.wide. 80 to 120 revs. per min.

Strapping.—See pages 53 and 54

Floor Space.—7ft. 9in. long × 6ft. 1in. wide = 2,36m. × 1,82m.

Approximate Weight.—Gross, 38 cwts.; net 30 cwts.

Approximate Cubic Measurement.—160 ft.

PATENT IMPROVED BEATER BARS AND TRUNK FOR OPENERS AND SCUTCHERS.

We take the opportunity of bringing before our clients a great improvement which we have recently effected in Openers and Scutchers. Formerly we employed a set of transverse or cross bars for the length of about quarter the circumference of the cylinder, followed by a subsidiary set of **longitudinal** bars for the remainder of the passage of the cotton leading to the cages. In the improved arrangement we now **dispense entirely with the longitudinal bars** to the cages, and instead thereof we continue the arch of the dust bars to rather more than half of the circumference of the cylinder, say from just below the feed rollers on one side of the cylinder to a corresponding point on the other side This improved construction necessarily causes the new design of the cotton passage to the cages, by means of a small "S" or swan-neck trunk. We claim for the improvement a considerable increase in the cleaning power of the opening and scutching machine, which is far in excess of what was obtained in the former system of combined transverse and longitudinal bars. The laps presented to the Carding Engine in the subsequent carding process are much cleaner, relieving that machine of a large percentage of its former work, and also such waste as is produced therefrom—being free of impurities—is enhanced in value.

Patent Improved Beater Bars and Trunk for Openers and Scutchers.

The results of our demonstrations to spinners generally of the benefits of the new cleaning system have resulted in many orders to change from former arrangements.

TESTS from 504 lb. of Good American.

New System ..... 9 lb. 13 oz. dirt
Old System..... 6 lb. 14 oz. dirt
Increased percentage 42 per cent.

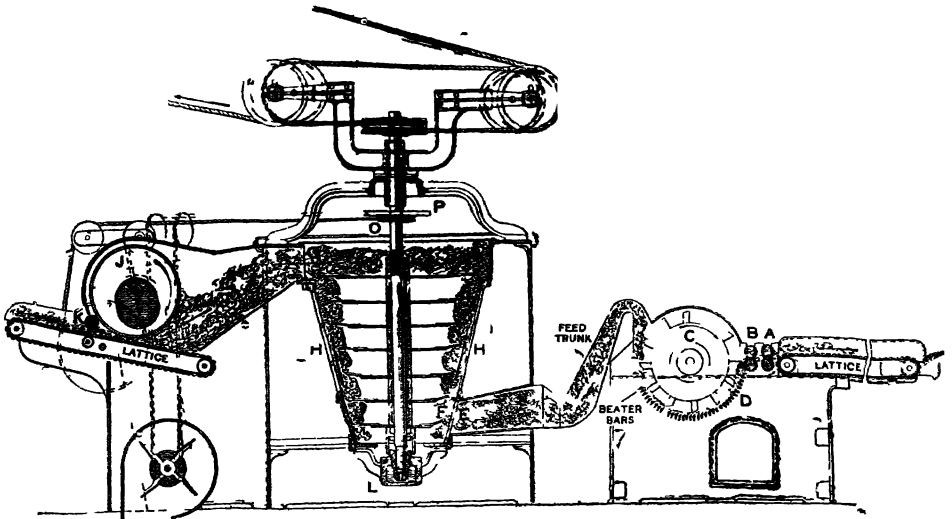
TESTS from 10 hours' working of Egyptian

New System ..... 100 lb. dirt
Old System..... 57 lb. dirt
Increased percentage 75 per cent.

TESTS from 5½ hours' working of Sea Islands

New System ..... 14 lb 4 oz. dirt
Old System..... 7 lb. 0 oz. dirt
Increased percentage 103 per cent.

The variation in percentage of droppings depends, of course, upon the class of cotton to be worked and its freedom from dirt and other impurities.



SECTION OF SINGLE VERTICAL BEATER OPENER WITH BALANCED ROPE DRIVING ARRANGEMENT AND PORCUPINE OPENER.

Vertical Beater Openers.

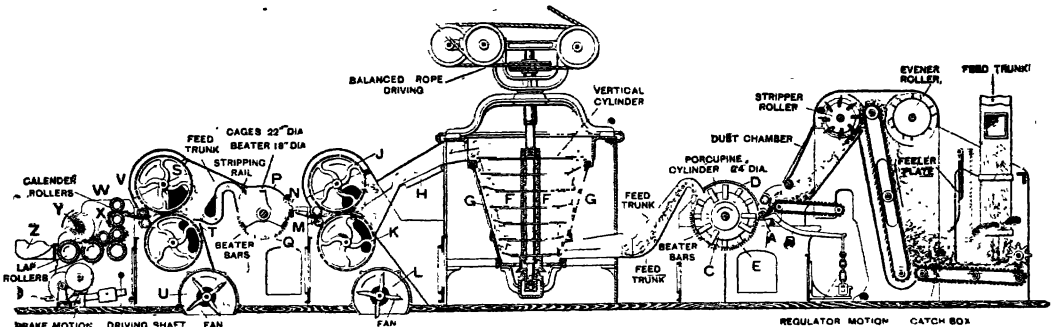
REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

A First feed rollers.
B Second feed rollers.
C Porcupine cylinder.
D Dust bars.
E Cotton inlet.
F Beater blades or discs.
G Cotton outlet.
H Beater grid
J Cage.
K Delivery roller.
L Beater footstep.
N Dust fan
O Rope pulley for driving delivery end.
P Rope pulley for driving fan.

NOTES.

	Power.	Production.	Pulleys and Speeds.
Single Opener.. ..	4 m h.p.	30,000 to 40,000 lbs. per week,	14in. dia. × 4½in. wide.
Double Opener ...	8 m h p	or with lap part attached up to about 30,000 lbs. per week	1000 revs. per minute.

	Floor Space.			Approximate Weights.		Approx. Cubic Measurement.
	ft. in. ft. in.		Metres.	Gross Cwts	Net Cwts	Feet.
Single Opener	10 5 × 5 4		3,17 × 1,63	67	50	325
Double Opener	16 6 × 5 4		5,03 × 1,63	106	82	525
If with Single Scutcher and Lap Machine for 38in. laps, add	9 1 × 7 0		2,76 × 2,14	94	73	368
If with Porcupine Opener with lattice feed 5ft. 6in. long, add.....	10 9 × 6 5		3,28 × 1,96	30	23	115
If with small Porcupine Opener and Hopper Feeder combined, add.....	12 10 × 6 5		3,91 × 1,96	67	53	269

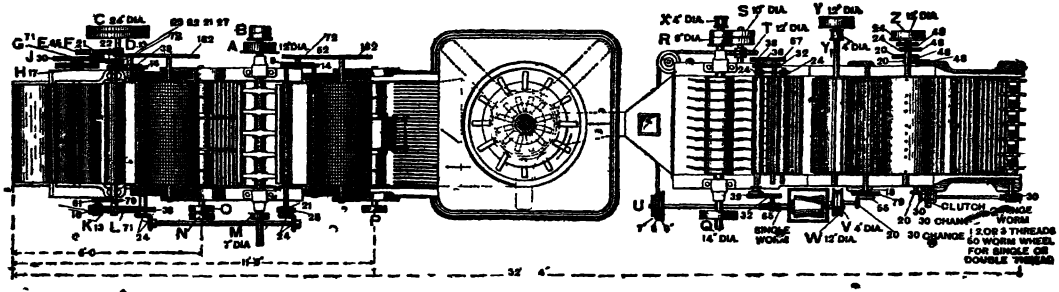


SECTION OF COMBINED VERTICAL BEATER OPENER.

Vertical Beater Openers.

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

A Pedal roller.
B Pedal.
C Porcupine cylinder.
D „ „ cover.
E „ „ dust bar.
F Vertical opener cylinder.
G „ „ dust grid.
H Longitudinal dust bars
J Top cage
K Bottom cage.
L Dust fan.
M Cage rollers.
N Beater feed rollers.
O Beater.
P „ cover
Q „ dust bar
S Second top cage.
T „ bottom cage
U „ dust fan.
V „ cage roller.
W Calender rollers.
X Fluted lap rollers.
Y Lap.
Z „ rest



GEARING PLAN OF COMBINED VERTICAL BEATER OPENER.

Vertical Beater Openers.

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

A Beater pulley, 12in. dia.

B ,, end pulley change for time to make lap, pulleys 5in, to 9in. dia.

C Lap end pulleys, fast and loose, 24 in. dia.

D Cross shaft wheel, 13 teeth, driving drop shaft

E Large drop shaft wheel, 65 teeth.

F Driving wheel for lap rollers, 21 teeth.

G, H Compound carrier for lap rollers, 11 teeth.

J Lap roller wheels, 30 teeth.

K Small wheel on drop shaft, 13 teeth.

L Bottom calender roller wheel, 71 teeth.

M Beater pulley to drive dust fans, 7in. dia.

N Second dust fan pulley, 6in. to 9in. dia.

O Pulley to drive first dust fan, 6in. to 9in. dia.

P First dust fan pulley, 6in. to 9in dia.

Q Porcupine cylinder pulley, 14in. dia

R ,, ,, end pulley, to drive regulator shaft, 8in. dia.

S Porcupine cross shaft pulley, to drive regulator shaft, 10in. dia., F. & L

T Porcupine cross shaft rope pulley, to drive regulator shaft, 12in. dia.

U Regulator shaft cone rope pulley, 7in., 8in. and 9in. dia.

V Pulley on top cone drum shaft, 4in. dia.

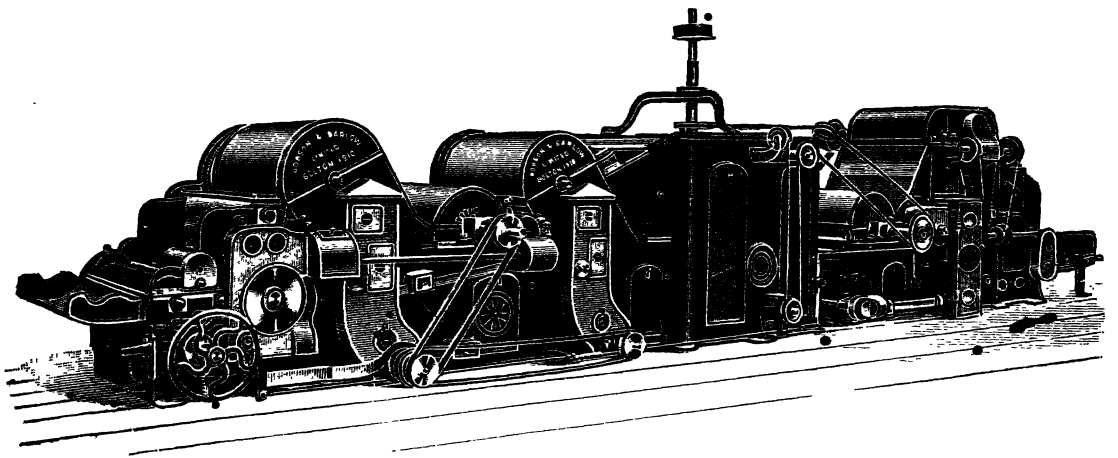
W Driving pulley for top lattice shaft, 12in. dia.

X Porcupine cylinder end pulley, to drive hopper feeder.

Y Stripper roller pulley.

Y^1 Pulley to drive evener roller, 4in. dia.

Z Evener roller driving pulley, 12in. dia



VERTICAL BEATER OPENER COMBINED WITH SINGLE BEATER SCUTCHER AND LAP PART, HOPPER FEEDER AND PORCUPINE OPENER.

Vertical Beater Openers.

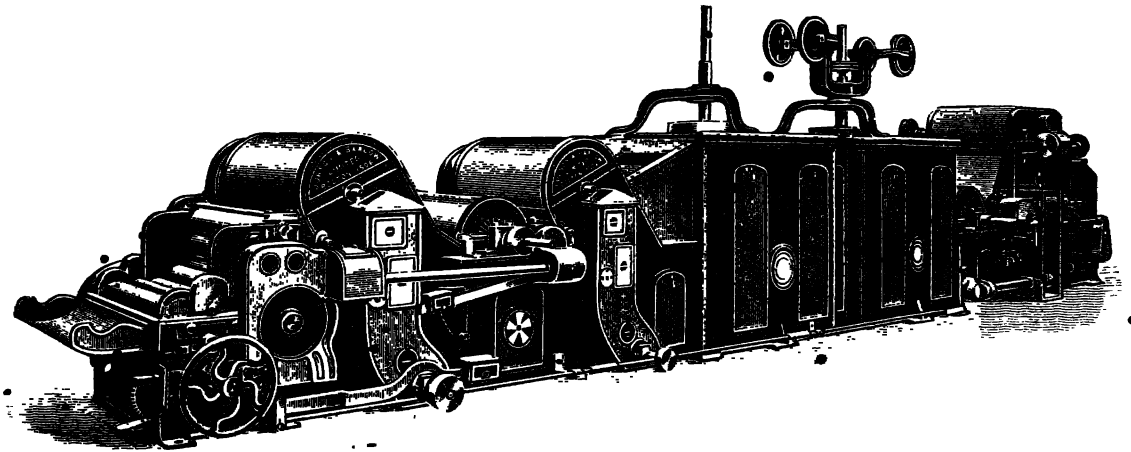
NOTES

	Power.	Production.	Pulleys and Speeds
Single Opener .	4 m h p	30,000 to 40,000 lbs. per week, or with lap part attached up to about 30 000 lbs per week	14in dia × 4½in wide
Double Opener .	8 m.h p		1,000 revs. per minute.

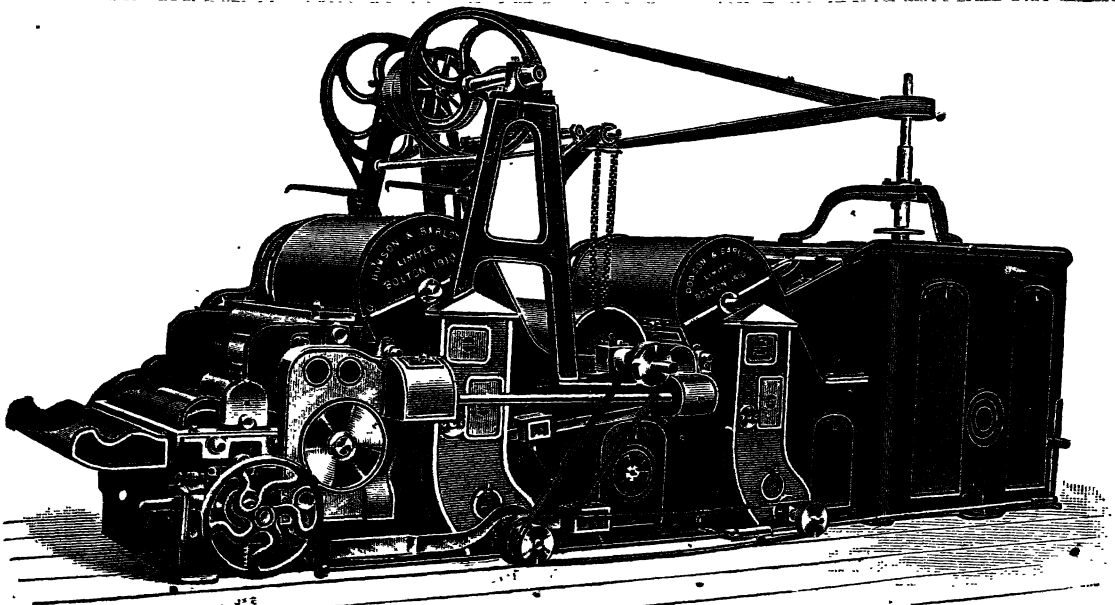
	Floor Space			Approximate Weights.		Approx. Cubic Measurement.
	ft. in ft in		Metres	Gross Cwts	Net Cwts.	Feet
Single Opener . . .	10 5 × 5 4		3,17 × 1,63	67	50	325
Double Opener.	16 6 × 5 4		5,03 × 1,63	106	82	505
If with Single Scutcher and Lap Machine for 38in laps, add..	9 1 × 7 0		2,76 × 2,14	91	73	368
If with Porcupine Opener with lattice feed 5ft. 6in. long, add	10 9 × 6 5		3,28 × 1,96	30	23	115
If with small Porcupine Opener and Hopper Feeder combined, add	12 10 × 6 5		3,91 × 1,96	67	53	269

Strapping.—See pages 53 and 54

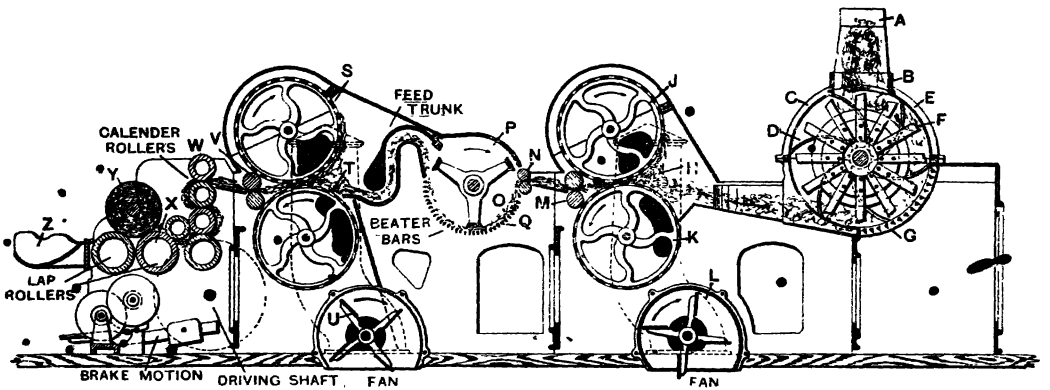
To determine hand of machine, stand at the feed end and note on which side the driving pulleys are to be placed.



DOUBLE VERTICAL BEATER OPENER COMBINED WITH SINGLE BEATER SCUTCHER AND LAP PART, HOPPER FEEDER AND PORCUPINE OPENER.



VERTICAL BEATER OPENER WITH SINGLE BEATER SCUTCHER AND LAP PART, COUNTERSHAFT FIXED ON MACHINE.

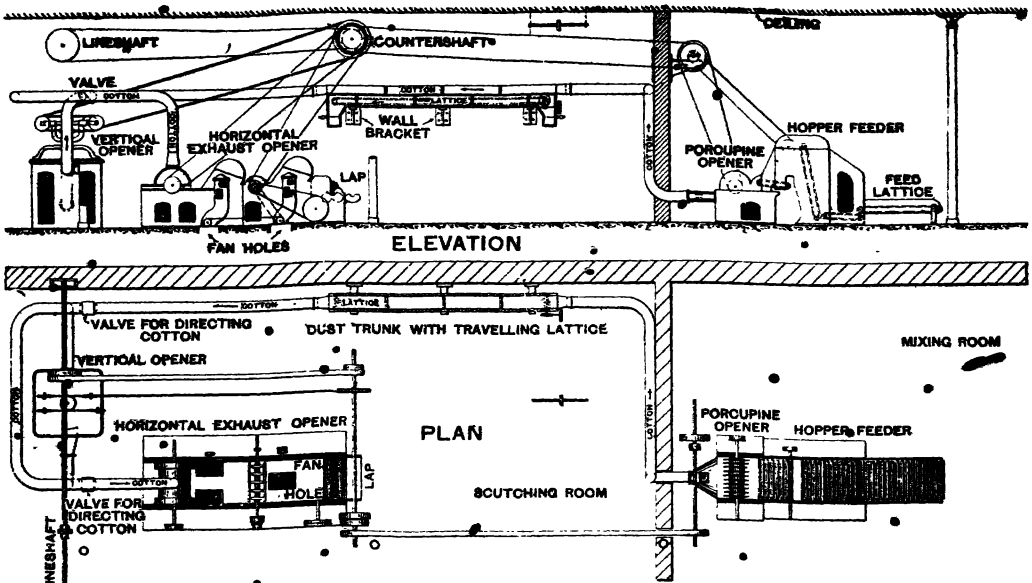


SECTION OF HORIZONTAL EXHAUST OPENER.

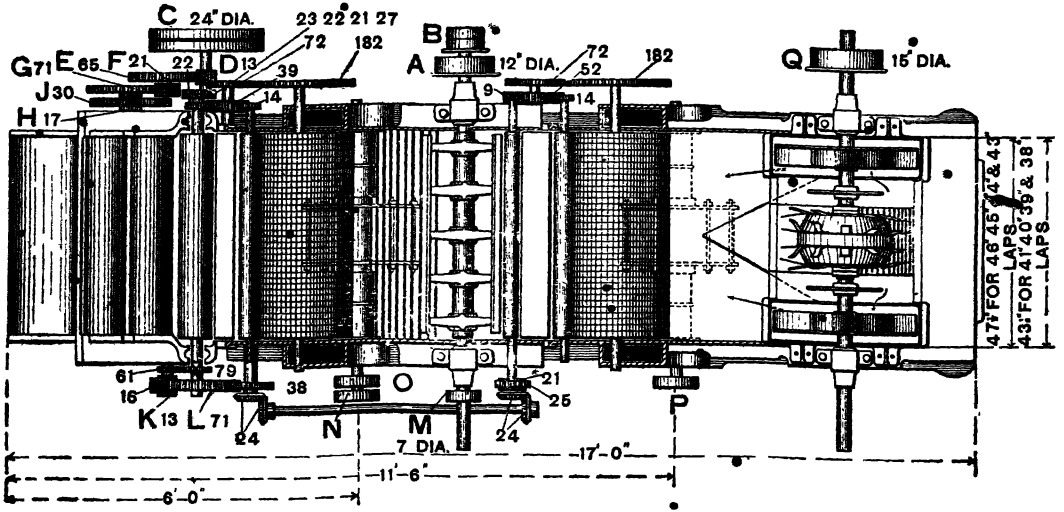
HORIZONTAL EXHAUST OPENER, No. 1 Model (Section).

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

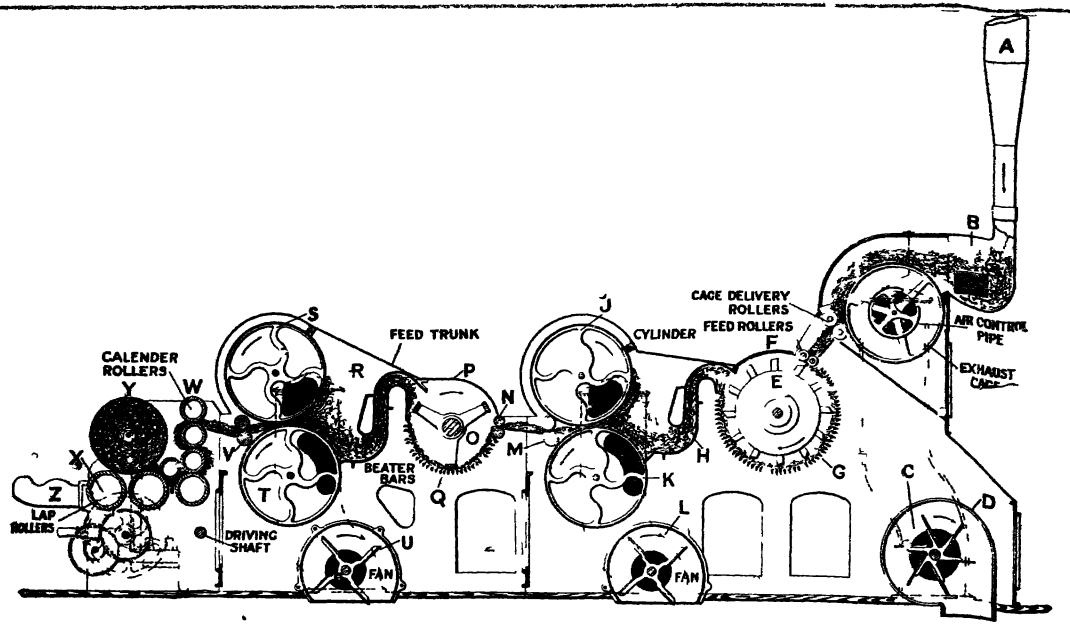
A Feed pipe.
B Mouthpiece
C Exhaust opener fan.
D „ „ „ cover.
E „ „ cylinder.
F „ „ „ cover.
G „ „ „ dust bar.
H Feed plate.
J Top cage.
K Bottom cage.
L Dust fan.
M Cage roller.
N Beater feed roller
O Beater.
P „ cover.
Q „ dust bars.
S Second top cage.
T „ bottom cage.
U „ dust bars.
V „ cage roller.
W Calender roller.
X Fluted lap roller.
Y Lap.
Z „ rest.



HOPPER FEEDER, PORCUPINE OPENER, DUST TRUNK WITH TRAVELLING LATTICE, BEATER AND HORIZONTAL EXHAUST OPENER.



GEARING PLAN OF EXHAUST OPENER, NO. I MODEL.

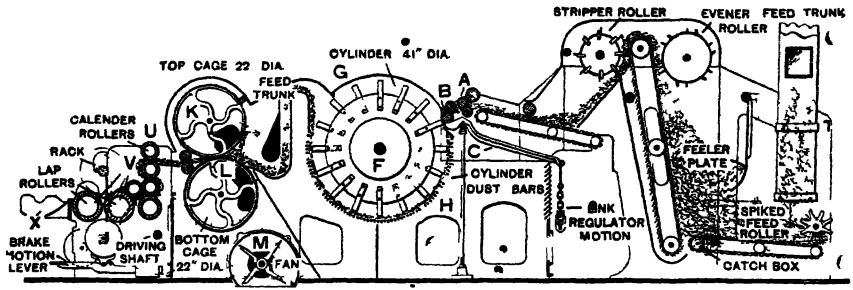


PATENT HORIZONTAL EXHAUST OPENER, NO 2 MODEL

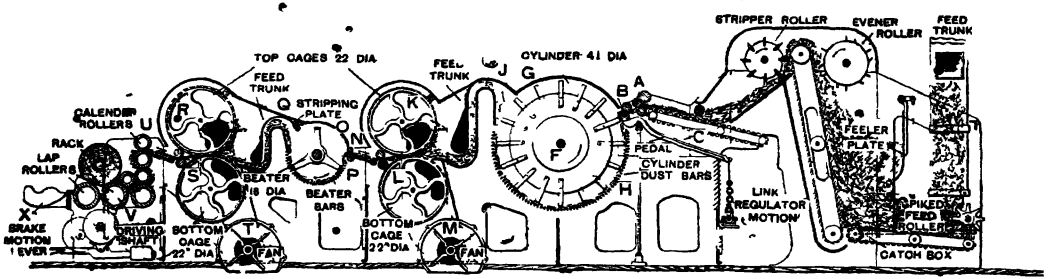
PATENT HORIZONTAL EXHAUST OPENER, No. 2 Model.

REFERENCES TO ILLUSTRATIONS ON PRECEDING PAGE.

A Feed pipe.
B Mouthpiece
C Exhaust opener fan
D ,, ,, ,, cover
E ,, ,, cylinder.
F ,, ,, ,, cover.
G ,, ,, ,, dust bars.
H Feed trunk.
J Top cage.
K Bottom cage.
L Dust fan.
M Cage rollers.
N Beater feed roller.
O Beater.
P ,, cover.
Q ,, dust bar.
R Feed trunk.
S Second top cage.
T ,, bottom cage.
U ,, dust fan.
V ,, cage rollers.
W Calender roller.
X Fluted lap roller.
Y Lap
Z ,, rest.



SECTION OF SINGLE LARGE SIZE HORIZONTAL OPENER.



SECTION OF DOUBLE LARGE SIZE HORIZONTAL OPENER.

Large Size Horizontal Openers.

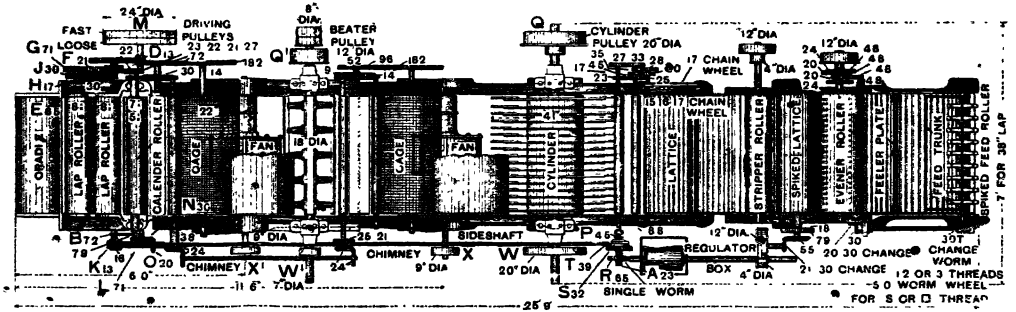
REFERENCES TO ILLUSTRATIONS ON PRECEDING PAGE.

A First feed roller.	O Beater cover.
B Pedal roller.	P Beater dust bars.
C Pedal.	R Second top cage.
F Porcupine cylinder.	S Second bottom cage.
G Cylinder cover plates.	T Second dust fan.
H Cylinder bars	U Calender rollers
K Top cage	V Fluted lap rollers.
L Bottom cage.	W Lap.
M Dust fan.	X Lap rest.
N Beater feeder rollers.	

NOTES.

	Floor Space.		Production.	Pulleys and Speeds.
	ft in. ft. in	Metres.		
Single Opener, 38in. lap	15 8 × 7 0	4,77 × 2,135	Up to 30,000 lbs. per week.	Cylinder, 20in. × 4½in. Single Opener 450 revs, Double Opener 500 revs.
Double Opener 38in. laps ..	21 2 × 7 0	6,45 × 2,135		Beater, 12in. × 4½in., 1,000 to 1,200 revs.
If with Hopper Feeder attached, add	4 8 to length	1,42		Lap end driving pulley, 24in. × 2½in.

	Power.	Approximate Weights.		Approximate Cubic Measurement.
		Gross Cwts.	Net Cwts.	Cubic Feet.
Single Opener. 38in. lap	5 m.h.p.	124	103	469
,, ,, 40in. ,, ...				
,, ,, 42in. ,, ...	5 ,,	126	104	476
,, ,, 46in. ,, ...	5 ,,	128	106	482
Double Opener, 38in. lap	10 ,,	159	130	633
,, ,, 40in. ,, ...				
,, ,, 42in. ,, ...	10 ,,	164	136	654
,, ,, 46in. ,, ...	10 ,,	172	142	688
If with Hopper Feeder, add—				
38in. lap	1½ ,,	38	30	165
40in. ,, ...				
42in. ,, ...	1½ ,,	39	31	176
46in. ,, ...	1½ ,,	41	32	198



PLAN OF GEARING OF DOUBLE HORIZONTAL OPENER.

DOUBLE HORIZONTAL OPENER.

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

A1 Cone wheel and cone driving wheel, $\frac{45}{21}$, $\frac{45}{33}$ or $\frac{45}{38}$.

B Hunter cog wheel; change for length of lap, 1 revolution of calender roller per tooth.

C Beater end pulley, change for time to make lap, pulley 5in. to 9in. diameter

D Driving cross shaft wheel, 13 teeth.

E Large wheel on drop shaft, 65 teeth.

F Driving pinion for lap rollers, 21 teeth.

G, H Compound carrier for lap rollers, $\frac{17}{71}$ teeth.

J Lap or shell roller wheels, 30 teeth.

K Drop shaft wheel, 13 teeth.

L Bottom calender wheel, 71 teeth.

M Lap end driving pulleys, 24in. diameter.

N Driving bevel for regulator side shaft, 30 teeth.

O Driven ,, on ,, ,, 15 to 20 teeth.

P Wheel on regulator side shaft driving cone drum wheel A.

Q Cylinder pulley.

Q1 Beater pulley.

R Worm wheel, 65 teeth.

S Worm wheel pinion, 32 teeth.

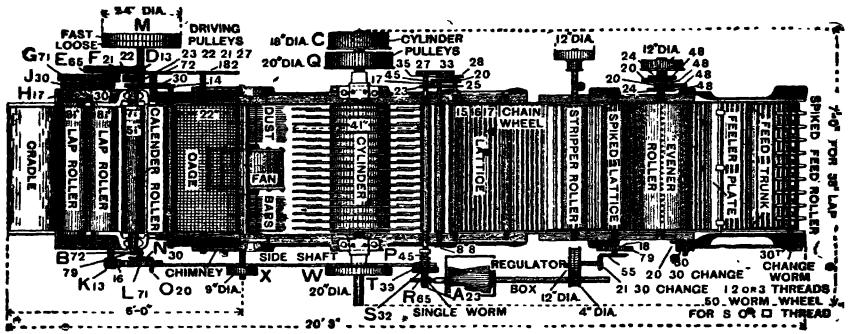
T Catch box wheel, 39 teeth.

W Cylinder pulley to drive cylinder fan, 20in. diameter.

W1 Beater pulley to drive beater fan, 7in. diameter.

X Cylinder fan pulley, 6in. to 9in. diameter.

X1 Beater fan pulley, 6in. to 9in. diameter.



PLAN OF GEARING OF SINGLE HORIZONTAL OPENER.

SINGLE HORIZONTAL OPENER.

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

AP Cone wheel and cone driving wheel, $\frac{45}{21}$, $\frac{45}{22}$, or $\frac{45}{23}$.

B Hunter cog wheel; change for length of lap, 1 revolution of calender roller per tooth.

C Cylinder end pulley, change for time to make lap, pulley 10 in. to 18 in. diameter

D Driving cross shaft wheel, 13 teeth.

E Large wheel on drop shaft, 65 teeth.

F Driving pinion for lap rollers, 21 teeth.

G, H Compound carriers for lap rollers, $\frac{17}{71}$ teeth

J Lap or shell roller wheels 30 teeth

K Drop shaft wheel, 13 teeth.

L Bottom calender wheel, 71 teeth

M Lap end driving pulleys, 24 in. diameter.

N Driving bevel for regulator side shaft, 30 teeth.

O Driven ,, on ,, ,, 15 to 20 teeth.

P Wheel on regulator side shaft driving cone drum wheel A.

Q Cylinder pulley.

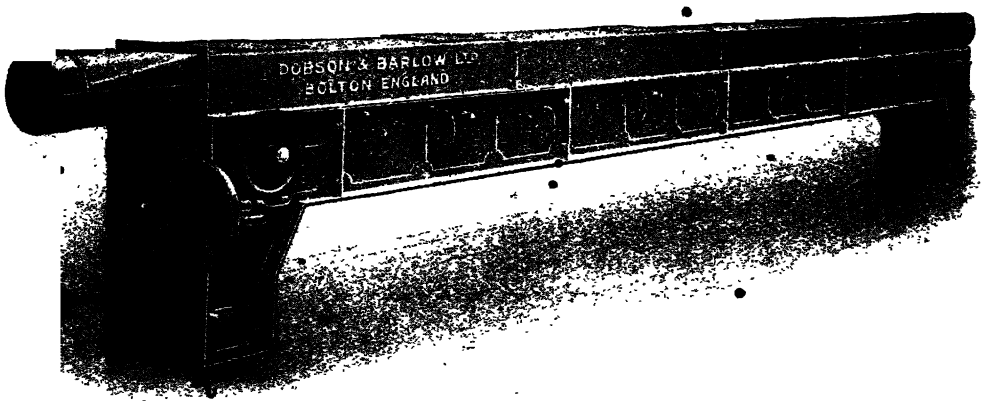
R' Worm wheel, 65 teeth.

S Worm wheel, 65 teeth.

T Catch box wheel, 39 teeth

W Cylinder pulley to drive fan, 20 in. diameter.

X Fan pulley, 6in. to 9in. diameter.



DUST TRUNK WITH TRAVELLING LATTICE.

STRAPPING AND BANDING REQUIRED FOR MACHINES.

The lengths of strapping given below for line shaft to machine, line shaft to counter shaft, and counter shaft to machine, may be taken as most usual, but, of course, vary according to circumstances. The lengths of banding may be taken as being correct.

HOPPER FEEDER :—

From line shaft or counter shaft to machine, 24 ft × 2½ in
If from opener cylinder, 19 ft × 2½ in
Stripper roller to evener roller, 7 ft. 6 in. × 2½ in.

PORCUPINE OPENER FEEDER.

Line shaft to counter shaft, 50 ft. × 5 in.
Counter shaft to cylinder, 24 ft. × 4 in.

SINGLE VERTICAL OPENER :—

Line shaft to counter shaft, 50 ft. × 5 in.
Counter shaft to cylinder, 30 ft × 4 in.
Banding, 66 ft of ⅝ in.

DOUBLE VERTICAL OPENER.

Line shaft to counter shaft, 50 ft. × 5 in.
Counter shaft to cylinder, 30 ft. × 4 in
Cylinder to cylinder 15 ft. × 4 in
Banding, 66 ft. of ⅝ in

IF SINGLE SCUTCHER, APPLIED (TO EITHER SINGLE OR DOUBLE VERTICAL OPENER) :—

Line shaft to counter shaft, 50 ft. × 5 in.
Counter shaft to beater, 24 ft. × 4 in.
Fan to fan 15 ft. × 2½ in.
Beater fan strap, 9 ft. × 2½ in.
Lap end, 15 ft. × 2½ in.
Cone regulator, 7 ft. × 1½ in.

Strapping and Banding required for Machines.—

(CONTINUED).

HORIZONTAL EXHAUST OPENER.—

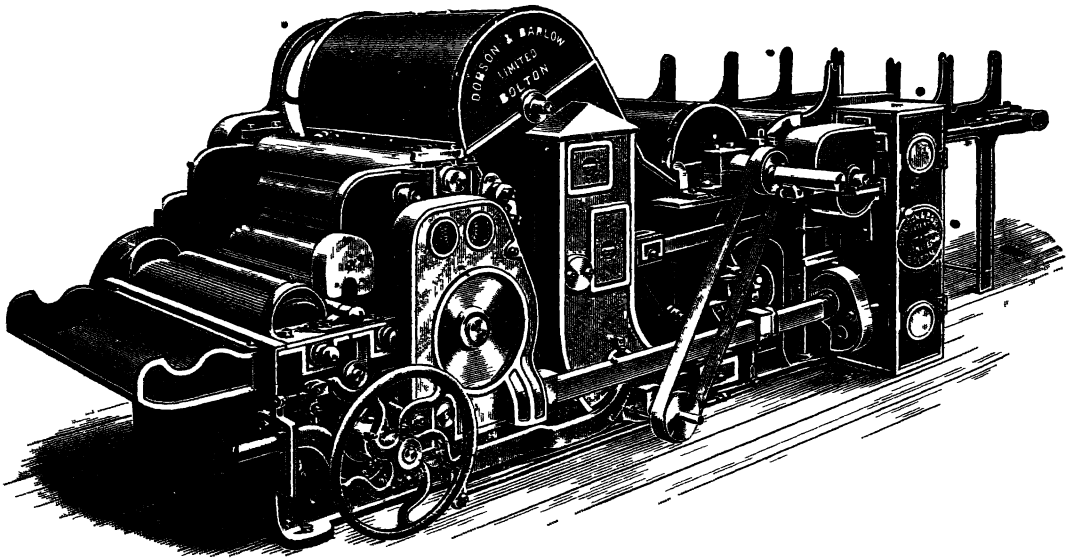
Line shaft to counter shaft, 50 ft. × 5 in.
Counter shaft to cylinder, 24 ft. × 4 in.
Counter shaft to beater, 24 ft. × 4in
Exhaust cylinder fan strap, 12 ft. × 2½ in.
Beater fan strap, 9 ft. × 2½ ins.
Fan to fan, 13 ft. × 2½ in.
Lap end, 15 ft. × 2½ in.
Cone regulator, 7 ft × 1½ in.

SINGLE HORIZONTAL OPENER AND LAP MACHINE:—

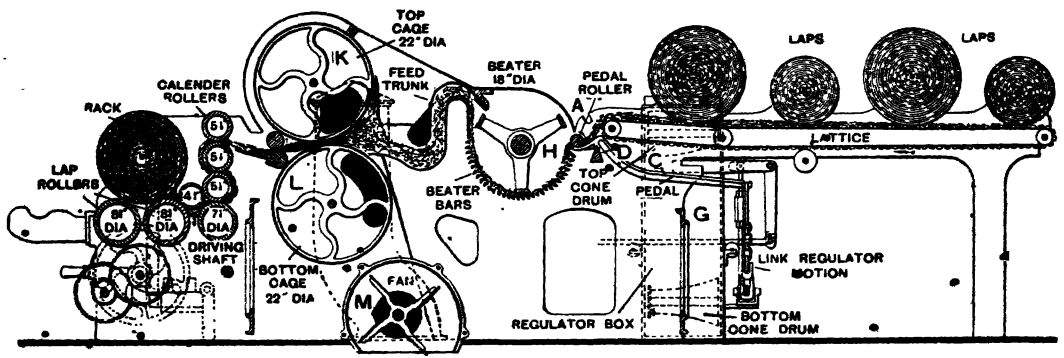
Line shaft to counter shaft, 50 ft. × 5 in.
Counter shaft to cylinder, 24 ft. × 4 in.
Cylinder fan strap, 13 ft. × 2½ in.
Lap end 19 ft × 2½ in.
Cone regulator, 7 ft. × 1½ in.

DOUBLE HORIZONTAL OPENER AND LAP MACHINE:—

Line shaft to counter shaft, 50 ft × 5 in.
Counter shaft to cylinder, 24 ft × 4 in.
Counter shaft to beater, 24 ft × 4 in.
Cylinder fan strap, 13 ft. × 2½ in.
Beater fan strap, 9 ft × 2½ in.
Fan to fan, 13 ft × 2½ in.
Lap end, 15 ft. × 2½ in.
Cone regulator, 7 ft. × 1½ in.



SINGLE SCUTCHER AND LAP MACHINE.



SECTION OF SINGLE SCUTCHER.

Scutchers.

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

A	Pedal roller.	K	Top cage.
B	Feed rollers.	L	Bottom cage.
C	Pedal.	M	Dust fan.
D	Knife rail.	N	Calender rollers.
G	Cone box	P	Fluted lap rollers.
H	Beater	Q	Lap.
I	Beater dust bars.		

NOTES.

WEIGHT OF SCUTCHER LAPS.

For Spinning Counts—	8's to 14's	15	ounces per yard.
	16's to 20's	14	,, ,,
	24's to 32's	13	,, ,,
	36's to 50's	12	,, ,,
	60's to 70's	11	,, ,,
	80's to 100's	10	,, ,,

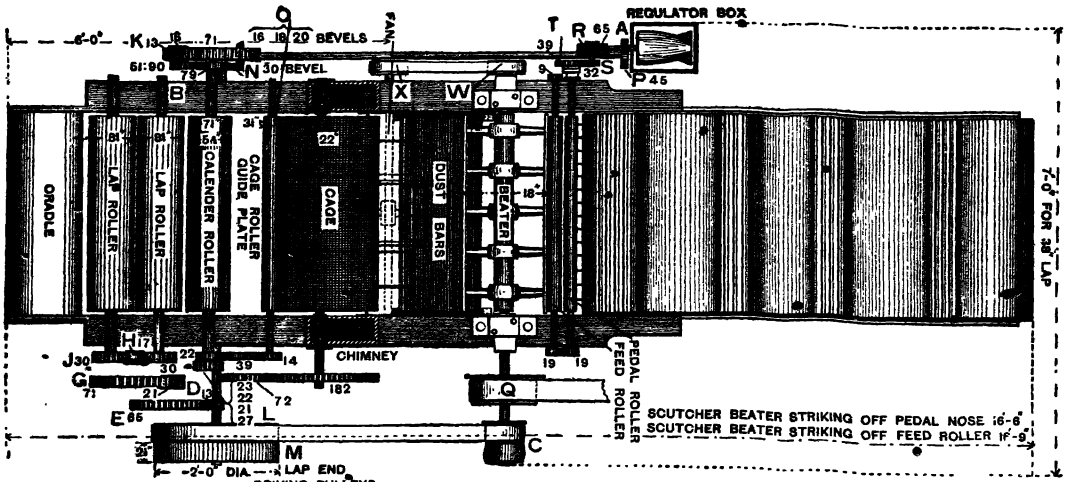
TABLE OF WEIGHT OF LAP.

10	ounces per yard	= .00190	hank lap.
10½	,, ,,	= .00180	,,
11	,, ,,	= .00173	,,
11½	,, ,,	= .00165	,,
12	,, ,,	= .00158	,,
12½	,, ,,	= .00152	,,
13	,, ,,	= .00146	,,
13½	,, ,,	= .00140	,,
14	,, ,,	= .00136	,,
14½	,, ,,	= .00131	,,
15	,, ,,	= .00127	,,

	Floor Space.		Production.	Pulleys and Speed.
	ft. in. ft. in.	Metres.		
Single Scutcher, 38in. laps	16 9 × 7 0	5,10 × 2,135	Up to 20,000 lbs. per week.	12in. × 4½in. 1,000 to 1,200 revs. per minute.
Double Scutcher, 38in. laps	22 1 × 7 0	6,73 × 2,135		

Lap end Driving Pulley, 24in. × 2½in.

	Power.	Approximate Weights.		Approx. Cubic Measurement.
		Gross Cwts.	Net Cwts.	Cubic Feet.
Single Scutcher, 38in. laps ..	4 n.h.p.	92	71	368
,, ,, 40in. ,, ..	4 ,,	93	75	372
,, ,, 42in. ,, ..	4 ,,	94	78	376
,, ,, 46in. ,, ..	4 ,,	96	83	384
Double Scutcher, 38in. ,, ..	8 ,,	136	103	559
,, ,, 40in. ,, ..	8 ,,	137	104	596
,, ,, 42in. ,, ..	8 ,,	138	105	638
,, ,, 46in. ,, ..	8 ,,	141	108	744



GEARING PLAN OF SINGLE SCUTCHER.

Single Scutcher.

STRAPPING REQUIRED (Single Scutcher).—Line shaft to counter shaft, 56ft. × 5in.; counter shaft to beater, 24ft. × 4in.: fan strap, 11ft. × 2½in.; lap end, 15ft. 2½in.; cone regulator, 7ft. × 1½in.

To determine hand of machine, stand at the feed end and note on which side the driving pulleys are to be placed.

No. of Machines ....
Width of Lap..... .....inches.
Revs. of Main Shaft per minute
„ Counter „ „ .....
„ Beater „ „ .....
„ „ Fan „ .....
„ Lap Rollers „ .....
Feed Lattice.....feet per minute.
Total Draft ....

One Beater 18in.....blades
Down Draughts.
Dia. of Drum on same.....
„ Pulley on same .....
„ Pulley on same .....
„ Pulley on same .....
Drum for Driving Beater.....
No. of Laps to be doubled .....
Kind of Cotton to be worked.....

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

AP Bottom Cone drum wheels Change for draft, $\frac{17}{21}$, $\frac{15}{23}$ or $\frac{13}{25}$.
B Hunter cog wheel. Change for length of lap, 1 revolution of calender roller per tooth.
C Beater end pulley. Change for time to make lap, pulley 5in. to 8½ in. dia.
D Bottom cross shaft wheel.
E Large wheel on drop shaft.
F Driving pinion for lap rollers.
G H Compound carrier for lap rollers.
J Lap or shell roller wheels.
K Drop shaft wheel.
L Bottom calender wheel.
M Lap end driving pulleys.
N Driving bevel for regulator side shaft.
O Driven bevel on regulator side shaft.
P Wheel on regulator shaft driving cone drum wheel A.
Q Beater pulley.
R Worm wheel.
S Worm wheel pinion.
T Catch box wheel.
W Beater pulley to drive fan.
X Fan pulley.

CALCULATIONS.

$$\text{Draft} = \frac{T \times R \times A \times O \times D \times F \times H \times \text{dia. of lap roller}}{S \times P \times N \times E \times G \times J \times \text{dia. of pedal roller}}$$

$$\text{Beater Pulley } Q = \frac{\text{Revs. of main shaft} \times \text{main shaft drum} \times \text{counter shaft drum}}{\text{Speed of beater} \times \text{dia. of pulley on counter shaft}}$$

$$\text{Fan Pulley } X = \frac{\text{Revs. of beater} \times W}{\text{Revs. of fan.}}$$

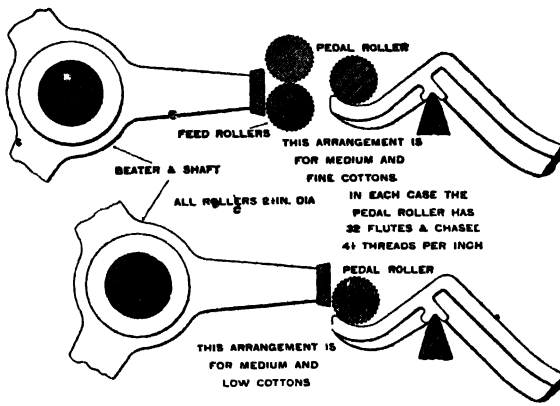
$$\text{Hank of Laps from counts spun} = \frac{\text{Counts} \times \text{doublings}}{\text{Draft at each machine from card to spinning machine}}$$

$$\text{To find the percentage of waste made} = \frac{\text{Loss in weight} \times 100}{\text{Weight of cotton fed to machine}}$$

SCUTCHERS.

The characteristics of these machines are —Effective cleaning power without injuring the staple, and the production of uniform laps with perfect selvages They are made with one or two beaters, as required, and have lap forming apparatus attached

The beaters are 18in. dia , and are made either with **two** or **three** hard steel blades The blades are planed on both edges, so that the beater can be reversed in case of wear The beaters can be arranged to strike from feed rollers or from the pedal nose, as desired Kirschner's improved toothed beater applied when specially ordered—for description see pages 78 and 79



ROLLER FEED AND PEDAL FEED

The cone feed regulator has large size horizontal cones, driven by gearing

Improved pedal motion, with link regulating motion attached See pages 76 and 77

Calender rollers are driven direct from beater, thus ensuring a uniform speed between the calender rollers and the feed rollers

Feed lattice driven at both ends, to avoid irregularity of tension

Lap rollers bored for patent lap rods

Improved adjustable beater bars

Transverse dust bars between the beater and the cages are shewn in the section of the machine, but we also make large numbers of machines with the dust bars arranged longitudinally

Improved adjustable wheels for setting lap racks

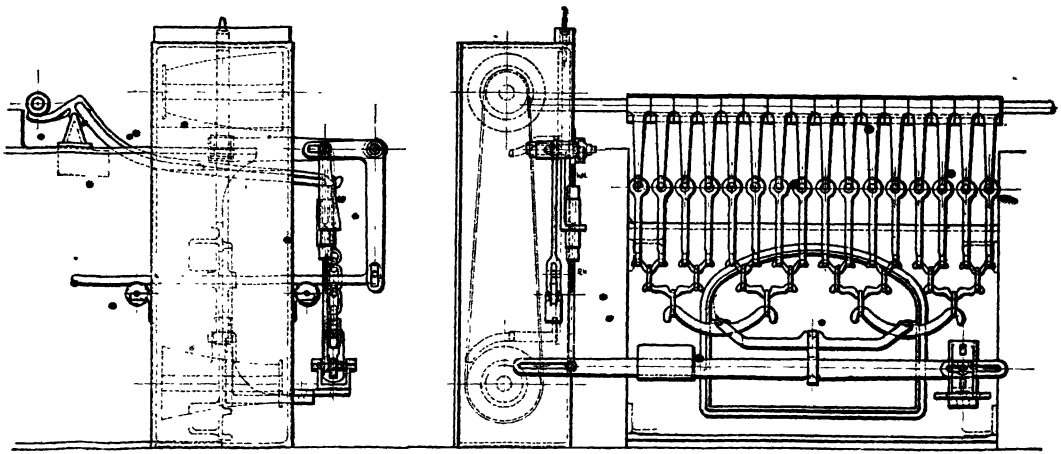
Improved dust cages.

Safety appliances to beater covers

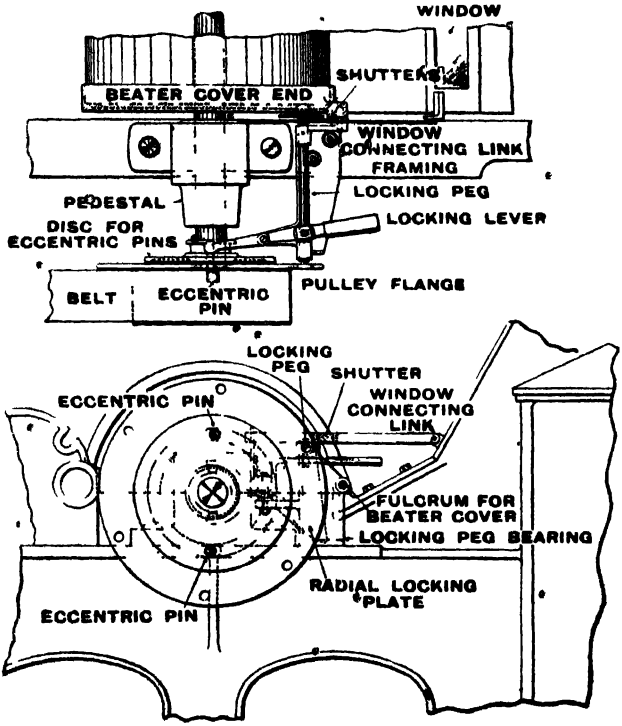
Improved calender roller clearers

Absolutely regular laps

Counter driving apparatus, with strap fork arrangement, may be fixed on the machine when it is inconvenient to carry same from pillars, walls or ceiling.



LINK REGULATING MOTION.



PATENT LOCKING MOTION FOR
OPENER AND SCUTCHER BEATER COVERS AND WINDOWS,
SHEWING COVERS CLOSED

Type A.

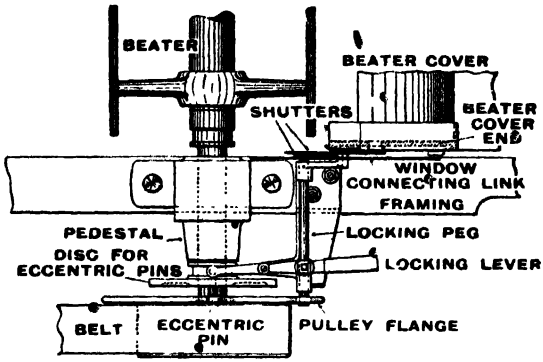
PATENT LOCKING MOTION FOR OPENER AND SCUTCHER BEATER COVERS AND WINDOWS.

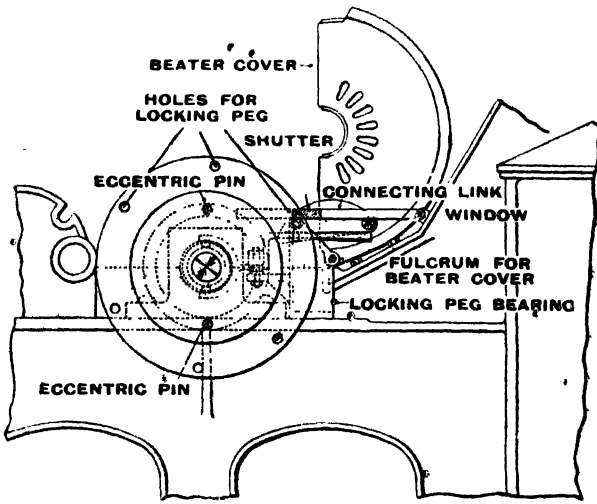
Hitherto accidents on the above machines have been all too numerous, and in many cases due to operatives being able to obtain access to the beater and adjacent parts whilst the machines were in motion. Of late we have spent much time in perfecting motions or devices whereby the above dangers may not only be minimised but absolutely eliminated. We achieve this by the motions illustrated as the four diagrams herein.

There are two methods shewn, and although they vary in mechanical construction, they are precisely the same in effect. We leave it to customers to choose the one most suitable to their requirements.

The action of parts is as follows:—

Type A.—When the beater cover and window are both closed, and the plunger or locking peg is pushed into the hole in beater cover end, the motion is locked. If the machine is started it will be seen that the locking peg cannot be withdrawn from the beater cover because, immediately the beater pulley moves through the slightest arc, it brings the full side of the eccentric pin opposite to the body part of the pulley, thereby making it impossible to withdraw the pin. Obviously there is always more or less side pressure on the eccentric pin whilst the pulley is in motion, even when the pulley is only just perceptibly moving. When the pulley is stopped and the side pressure on eccentric pin incidentally removed, it is easy to turn the pulley backwards by an



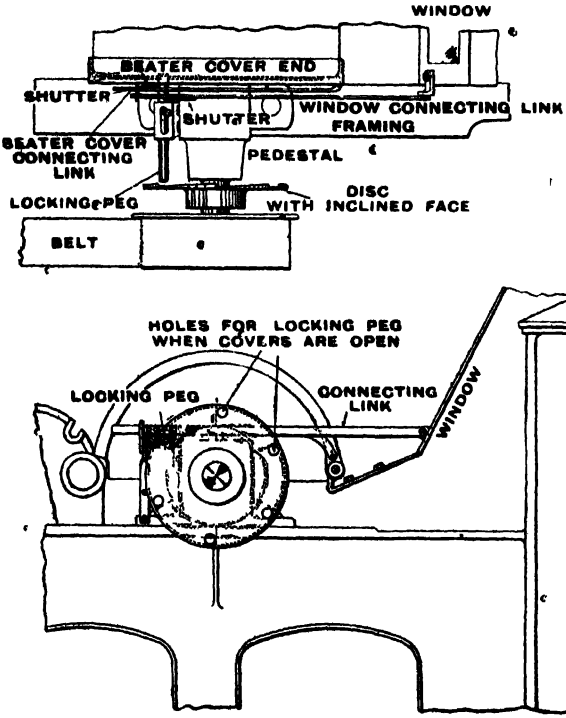


PATENT LOCKING MOTION FOR
OPENER AND SCUTCHER BEATER COVERS AND WINDOWS,
SHEWING COVERS OPEN.

Type A.

amount equal to the overlap of eccentric pin. When in this latter position the eccentric pin and the locking peg are simultaneously withdrawn from their respective sockets, by the one action of the lever, and the covers are free to be opened at will. In order to fulfil the conditions of a perfect safety motion, there must be some provision for preventing the machine from starting whilst the covers are open. We have effected this in an extremely simple manner Considering the beater cover only first; we have provided the beater cover end with an extended plate shaped radially from the fulcrum of the cover. From the illustration it will be seen that when the cover is hinged, even to its limit, the said extention plate is long enough to act as a shutter over the hole in locking peg bearing, thus making it impossible to move the locking peg in the direction of the cover. Now, assuming the beater cover to be closed and the window open, exactly the same effect is obtained by the small shutter plate on window connecting link. It is clear that however slightly the window is opened the shutter plate is carried either wholly or partially in front of the hole in locking peg bearing. In order to avoid any adjustment of parts when the covers are all closed, we prepare the pulley flange with a series of holes for the locking peg corresponding exactly with those for the eccentric pin, so that when it is required to start the machine the lever is merely moved to the locked position

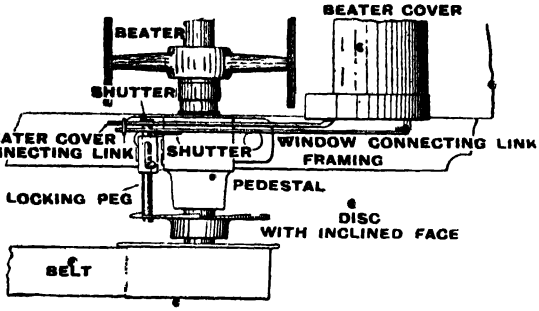
Type B.—Instead of the eccentric pin and its disc, we have in this type another form of disc provided with a series of inclined strips on the inside face. The function of these inclines is to prevent any chance of the locking peg

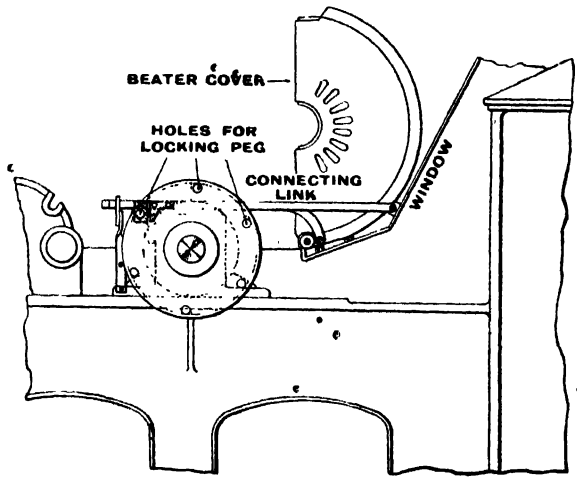


PATENT LOCKING MOTION FOR OPENER AND SCUTCHER BEATER COVERS AND WINDOWS, SHEWING COVERS CLOSED

Type B.

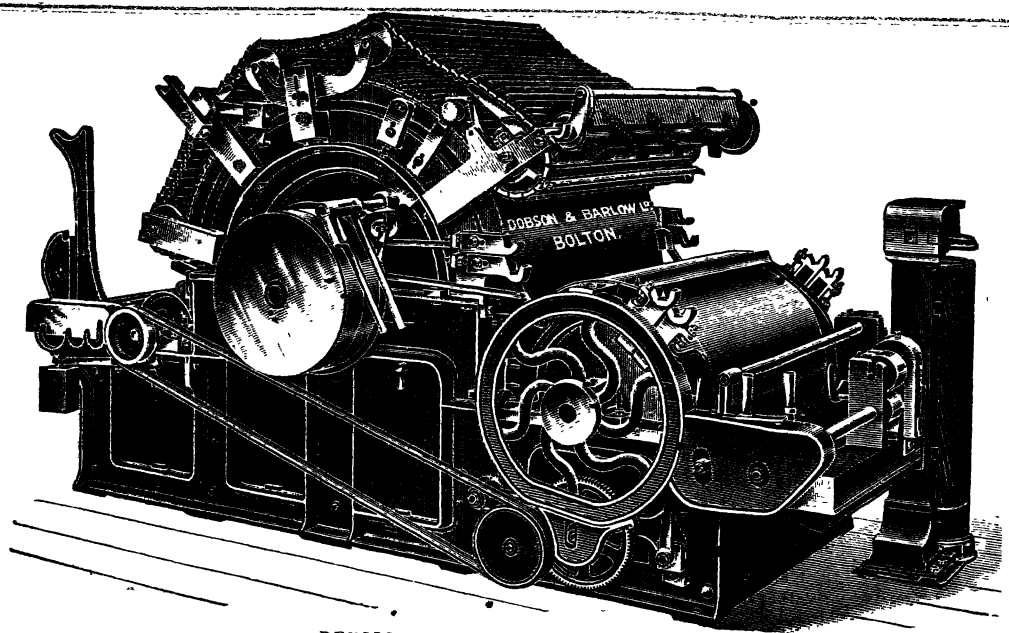
being withdrawn from the Beater Cover whilst the Beater is slowing down. It will at once be seen that if the operative should try to withdraw the locking peg whilst the machine is running, the inclines will continue to push the peg back. Further, when the peg is on the highest point of incline, it will be found that however quickly the peg is pushed outwards, the distance from top of incline to the level of hole is such as to give ample time for a slight movement of the pulley and consequently the disc, thereby preventing further movement of the peg. The locking arrangement when the covers are open is very similar to that described under **A** type, except that instead of the plate on the beater cover end, we employ a connecting link similar to that used on the window. The two types are put forward with a view to meeting the requirements of various types of machines.



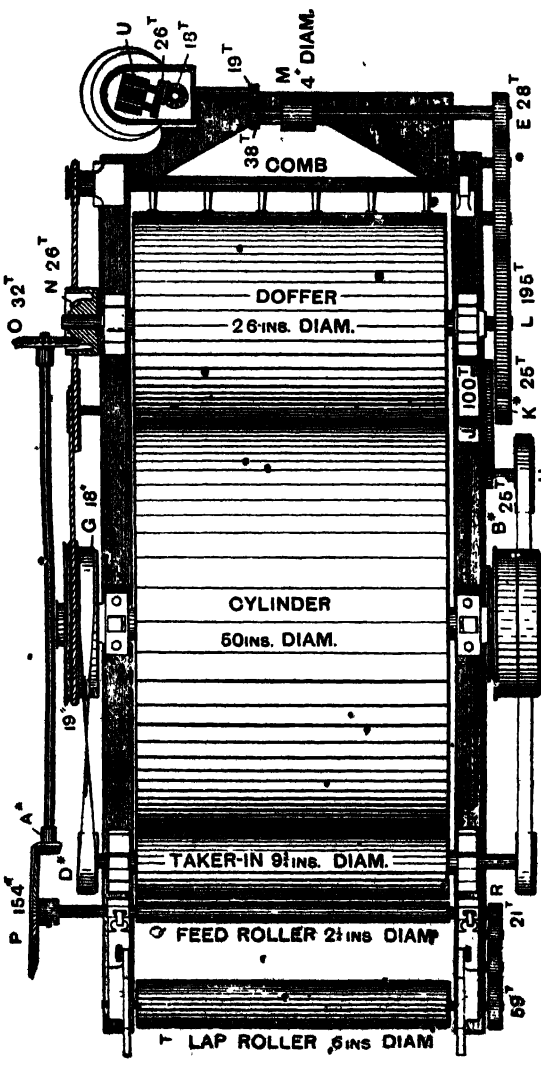


PATENT LOCKING MOTION FOR
OPENER AND SCUTCHER BEATER COVERS, AND WINDOWS,
SHEWING COVERS OPEN.

Type B.



REVOLVING FLAT CARDING ENGINE.



GEARING PLAN OF REVOLVING FLAT CARD.

5 Setting Point Carding Engine.

No. of Cards.....	Width of Lap .....
Dia. of Main Cylinder .....50 in.	Dia. of Doffer ....26 in.
„ Taker-in . over teeth 9½ in.	Number of flats.....109
One 2½ in. Feed Roller with Dish.	One Lap Roller..... .....6 in. dia.
Revs. of Main Shaft per minute... ...	Dia. of Drum on same.....
Dia. of Pulley on Card	Revs. of Cylinder per minute.....
Dia. of Grinding Roller ..... 6 in.	Kind of Cotton to be worked.....
Weight of Lap per yard.	Sliver produced per yard.....
Calender Rollers .....4 in. dia.	Strokes of Comb per minute.....
Length of Can	Dia. of Can.....

References to Illustration on preceding Page.

A Feed or draft wheel. Change place, 10 to 40 teeth.
B Barrow wheel. Change place, 18 to 36 teeth.
C Taker-in pulley. Change place, 4 in. to 4½ in. dia.
D Taker-in pulley. Change place, 6 in. to 10 in. dia.
E Calender block wheel. Change place, 24 to 32 teeth.
F Driving pulley.
G Taker-in driving pulley.
H Swing lever pulley.
J, K Compound carrier for swing lever.
L Doffer wheel.
M Calender roller.
N Side shaft driving bevel wheel.
O Side shaft bevel wheel.
P Feed roller wheel.
Q Feed roller.
R Lap roller driving wheel.
S Lap roller wheel, 59 teeth.
T Lap roller.
U Coiler calender roller.

Calculations.

$$\text{Total Draft} = \frac{S \times P \times O \times L \times \text{dia. of } M}{R \times A \times N \times E \times \text{dia. of } T}$$

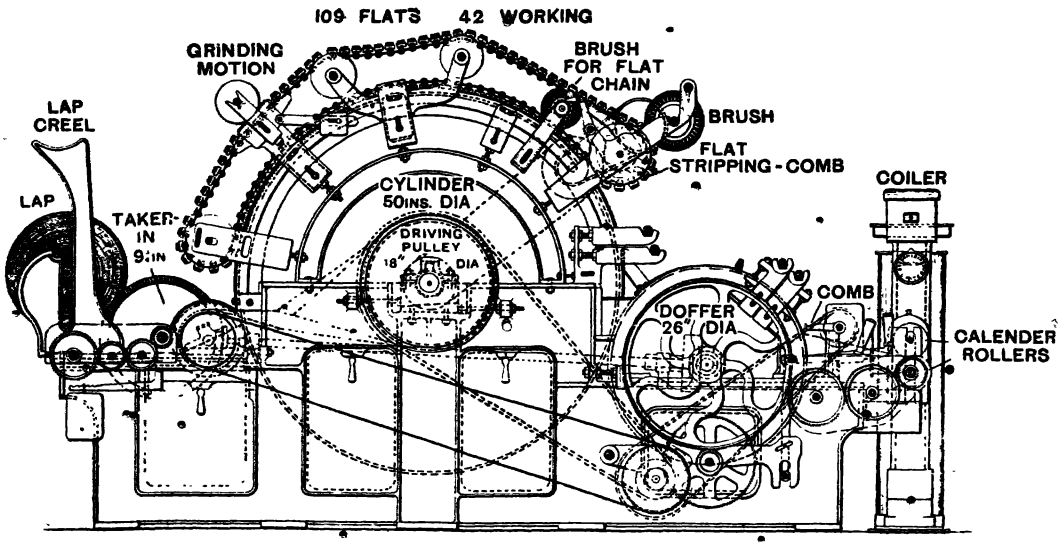
$$\text{Draft wheel } A = \frac{S \times P \times O \times L \times \text{dia. of } M}{R \times \text{draft} \times N \times E \times \text{dia. of } T}$$

$$\text{Production in 10 hours} = \frac{\text{minutes in 10 hours}}{} \times \text{revs. of doffer} \times 26\tfrac{3}{4}\text{ in.} \times 3{\cdot}1416 \times \frac{\text{weight of sliver in grains per yard}}{36 \times 7{,}000}$$

$$\text{Constant Number} = \frac{S \times P \times O \times L \times \text{dia. of } M}{R \times N \times E \times \text{dia. of } T}$$

$$\text{Draft Wheel } A = \frac{\text{constant number}}{\text{draft required}} \qquad \text{Total Draft} = \frac{\text{constant number}}{\text{draft wheel } A}$$

$$\text{Draft between Feed Roller and Doffer} = \frac{P \times O \times \text{dia. of doffer}}{A \times N \times \text{dia of } Q}$$



REVOLVING FLAT CARDING ENGINE.

Carding Engines.

Counts of Wire.

	Indian.		Brazilian.	American.	Egyptian.		Sea Islands.
	Low.	Good.			Ord.	Super.	Super.
Cylinder... ...	80's	90's	90's	100's	110's	120's	130's
Doffer.....	90's	100's	100's	110's	120's	130's	140's
Flats.....	90's	100's	100's	110's	120's	130's	130's

Card Cylinder Speeds.

Driving pulley, 18 in. dia., 3 in. wide.

Indian Cotton.....	180	revs per minute.
American Cotton.....	170	,, ,,
Egyptian Cotton	160	,, ,,
Sea Islands Cotton	155	,, ,,

We supply, where required the ordinary slow grinding motion only, for grinding cylinder and doffer, one only of which is required for 30 cards

Notes.

Each card has 109 flats, 1⅜ in. broad.

Power.—1 m.h.p.

Production.—Per day of 10 hours.—

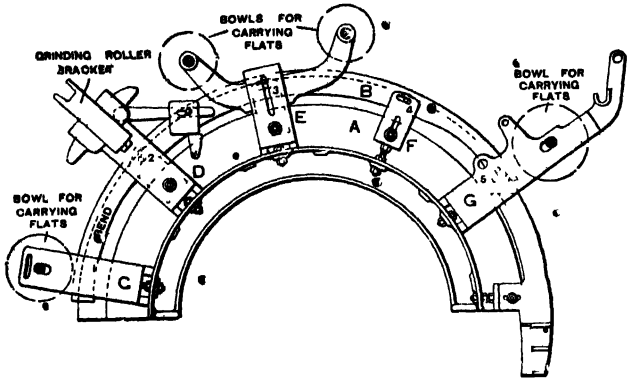
Indian Cotton.....	159 to 230 lbs	According to quality of cotton.
Russian and American Cotton	106 to 177 ,,	
Egyptian Cotton.....	44 to 106 ,,	
Sea Islands Cotton	27 to 53 ,,	

Table of Weight of Lap.

10 oz.	per yard	= ·00190	hank lap.
10½ oz.	,,	= ·00180	,,
11 oz.	,,	= ·00173	,,
11½ oz.	,,	= ·00165	,,
12 oz.	,,	= ·00158	,,
12½ oz.	,,	= ·00152	,,
13 oz.	,,	= ·00146	,,
13½ oz.	,,	= ·00140	,,
14 oz.	,,	= ·00136	,,
14½ oz.	,,	= ·00131	,,
15 oz.	,,	= ·00127	,,

Floor Spaces, etc.

Dia. of Cylinder.	Dia. of Doffer.	Dia. of Taker-in.	Width on Wire.	Floor Space.					
				Ft	in.	Ft.	in.	Mètres.
Inches.	Inches.	Inches.	Inches.					
50	26	9½	37	10	2	× 5	1	3,101 × 1,55
50	26	9⅝	38	10	2	× 5	2	3,101 × 1,57
50	26	9¾	39	10	2	× 5	3	3,101 × 1,60
50	26	9⅞	40	10	2	× 5	4	3,101 × 1,62
50	26	9⅞	41	10	2	× 5	5	3,101 × 1,65
50	26	9½	45	10	2	× 5	10	3,101 × 1,78



IMPROVED FLEXIBLE BEND FOR OUR ORDINARY CARDING ENGINE

This bend is an improvement upon the old form of setting with five points.

Case-hardened pins, 1, 2, 3, 4 and 5, are fixed in the bend B, and are connected with adjustable brackets, C, D, E. F. and G, which are firmly secured to the turned framing A.

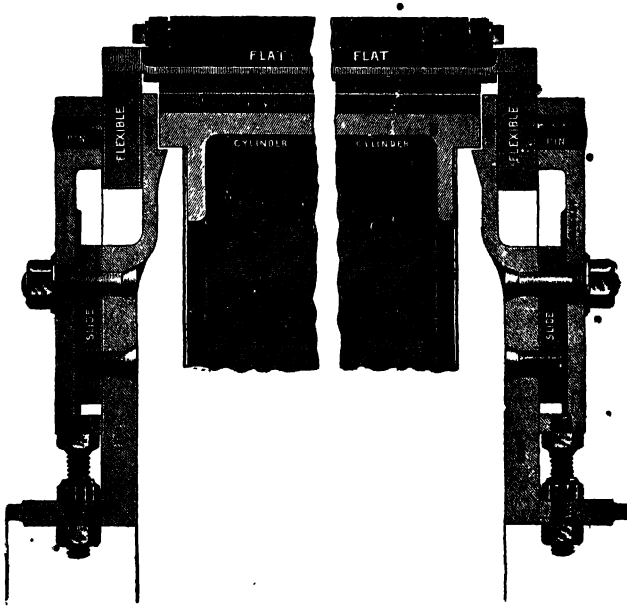
When setting, the brackets are moved radially towards or from the centre of the cylinder by means of fine threaded screws and nuts bearing against a rim on the frame side.

To compensate for the varying diameter of the bend, slots are provided in the brackets D, E, F and G.

The bend is perfectly rigid, and forms a solid surface for the flats to work upon.

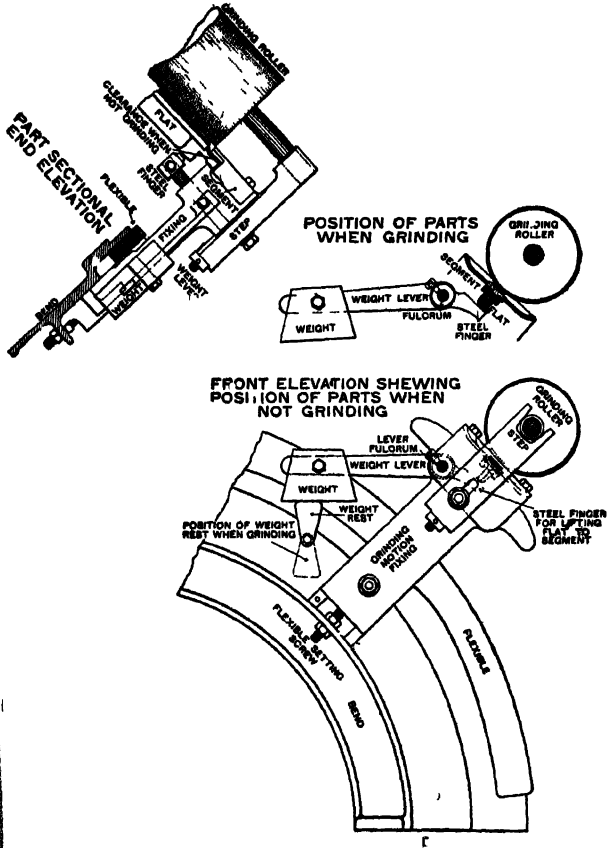
IMPROVED 5 SETTING POINT FLEXIBLE BEND.

A most valuable improvement has been introduced in our Cards in the form of an arrangement which permits the flexible to be adjusted from 5 setting points—in this



IMPROVED 5 SETTING POINT FLEXIBLE BEND.

way a wider setting can be obtained over the taker-in. The illustration on page 94 shews the flexible and brackets, whilst the section shewn above will convey an idea of the method adopted for adjusting the flexible—it is exceedingly simple in arrangement and by it the finest possible adjustment can be obtained.



PATENT FLAT GRINDING APPARATUS, SHEWING GRINDING ROLLER IN POSITION.

PATENT FLAT GRINDING APPARATUS.

Our patent anti-flexion apparatus for grinding the revolving flats is applicable to any type of revolving flat card.

We are extremely pleased to say that we can claim undeniably to have **overcome the whole of the objections** existing in other grinding motions, and the motion we supply has the following advantages over any other :—

1. There is **no moving part** in the motion controlling the grinding.
2. The **ordinary** size of **grinding roller** can be used.
3. There is **no movement in the axis of the grinding roller** itself.
4. **Each flat** on the card is bound to be **precisely the same** as the other flats—there is no possibility of its being otherwise.
5. Whatever the **wear and tear** on the end of the flats, it is **regulated by the grinding roller.**
6. There are no corners or shelves for the lodging of **fly or dirt.**
7. The **grinding surfaces** are **automatically cleaned** by the passage of the flats.
8. The motion requires absolutely **no attention.**
9. **The setting** of the grinding roller is **more readily executed,** as the motion is in the **most favourable position** for doing this.

MIXED CARDING ENGINES.

SPECIALITIES AND IMPROVEMENTS.

The principal feature of this Mixed Card is the introduction of two 5 in dia rollers and two 3 in dia. strippers, in combination with 74 flats, the advantages claimed being that the cotton is dealt with better, the rollers and strippers relieving the flats.

The cover is made of planished steel, and a trough is applied underneath the first roller to collect the waste, and is so arranged that the waste can be removed without fear of accident to the attendant.

A steel regulating plate is placed between the last roller and the flats.

The taker-in is provided with a combined adjusting arrangement, by which the whole of the adjacent parts are moved into position simultaneously. When necessary, the undercasings and mote knives can be independently adjusted.

The doffer is provided with a patent combined adjusting arrangement, by which the whole of the adjacent parts are moved into position simultaneously.

The cylinder is provided with a wedge setting arrangement for setting the cylinder to the flats.

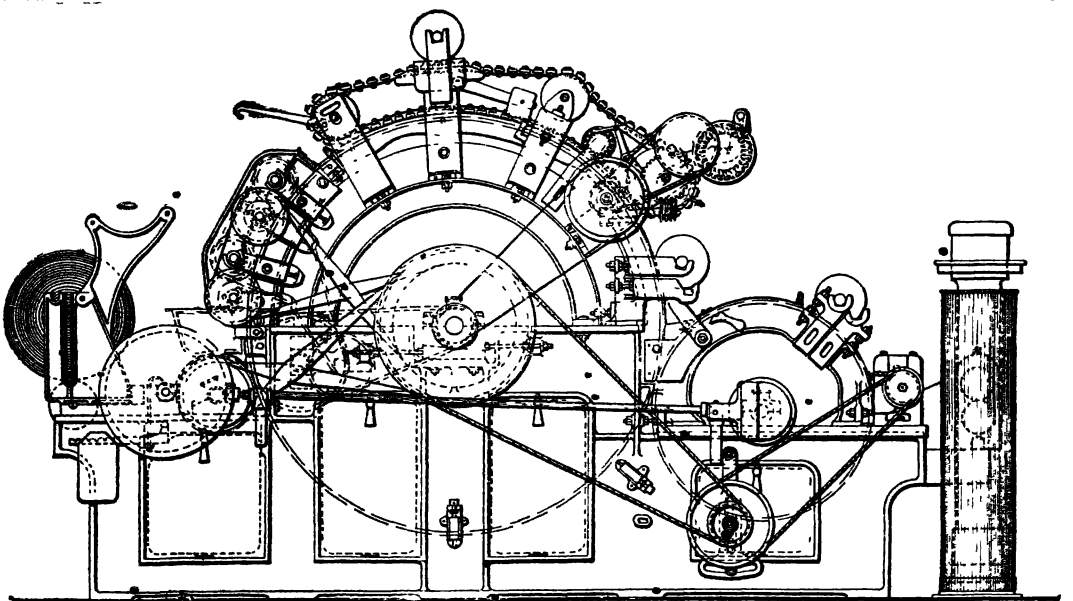
The doffer cover, front knife or fly plate between the flats and the cylinder, and the front half of the cylinder undercasing are adjusted simultaneously by means of a combination between the nose of the bend and a circularly trued segment.

The doffer grinding roller brackets are attached to the doffer pedestals, so that when grinding the grinding roller cannot get cross wound.

A sheet-iron dividing plate, with door, separates the waste of the cylinder from that of the taker-in

The cylinder is brought as close up to the bend as possible, thus preventing draughts with their attendant evils of waste, fly and cloudiness; the arrangement also dispenses with making-up pieces between bend and cylinder.

Between the cylinder and doffer we insert a polished steel cover with making-up piece combined, which is hinged and arranged to be adjusted concentrically, according to the length of the card wire. When stripping and grinding, the hinged part of this cover next to the cylinder is turned down, and, when setting, the gauge is inserted between the cylinder and doffer, and the whole appliance is moved concentrically over the doffer and is retained by a catch.



MIXED CARD SHEWING COVER IN POSITION.

Mixed Carding Engines.

To prevent clouding or the formation of "cat-tails," the part of the cover which descends between the cylinder and doffer is planed to a knife edge and polished.

The doffer-comb motion is self-lubricating, and will run at the highest speed without vibration.

The cylinders and doffers are accurately balanced by a special apparatus, and afterwards trued up the whole of their surfaces by emery wheels.

Patent eccentric star wheel motion for driving the flats. This motion prevents tilting of the flats.

All pulleys are balanced.

The finish of this card throughout is of the highest class, and the different parts are made to templates and finished by the most modern tools, thus ensuring accuracy, easy running, steadiness and light driving power.

The flats are tested to 1oooth part of an inch by a special apparatus, and are accurately clothed by a patent continuous clamp, which prevents fraying at the edges and the accumulation of fly. A patented end clip is now applied and giving excellent results, the wire on the ends of the flats being fully protected by it.

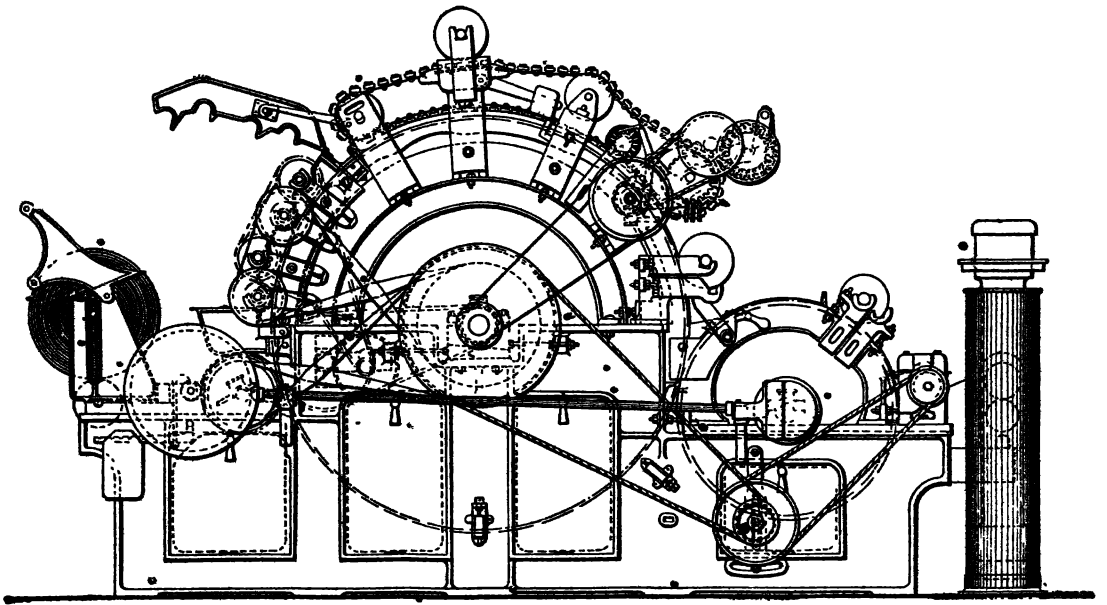
When desired, lap racks arranged to take two laps are applied

A slow driving arrangement is applied to the flat stripping brush, which ensures longer life for the brush and better clearing of the flats.

When desired, a locking motion for stripping door is applied, so that the stripping door cannot be opened until the card has come to a dead stop; and further, the card cannot be started again until the stripping door has been closed

When required a patent slow motion can be applied to each card for grinding the cylinder and doffer, and which also stops or reduces the speed of doffer when the sliver is broken. No changing of pulleys or wheels required.

Or—we supply, when required, the ordinary slow grinding motion only, for grinding cylinder and doffer, one only of which is required for 30 cards.



MIXED CARD SHEWING COVER LIFTED UP.

Mixed Carding Engines.

Notes

Each card has 74 flats, 1⅜in broad, 2 rollers 5in dia and two strippers 3in dia

Power —1 m h p

Quality of Cotton Treated —Waste American and dirty Egyptian

Speeds —Driving pulley 18 in dia × 3 in wide 160 to 180 revs per minute according to the class of cotton

Strapping —Line shaft to cylinder 27 ft × 3 in , licker in strap, 10 ft × 2 in , barrow pulley strap, 15 ft × 2 in , flat driving strap, 7 ft × 1½ in , barrow pulley strap with slowering motion, 14 ft × 1¼ in Banding, 34 ft of ⅜ in

Approximate Weights and Cubic Measurements

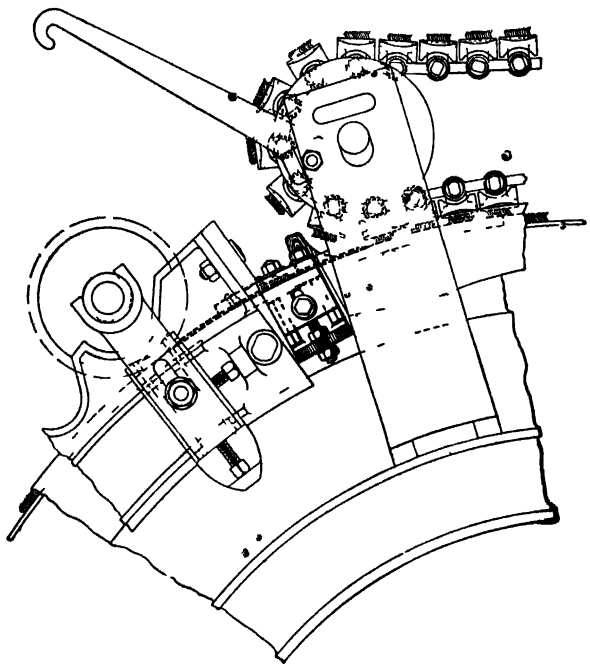
	Gross	Net	Cubic Measurement
	Cwts	Cwts	Feet
37in on wire	6¼	47	250
38in	6 3	48	53
39in	6 3 3	48¾	56
40in	6 4	49	259
41in	6 4 ¾	49¼	262
45in	67	52	276

Floor Spaces, etc

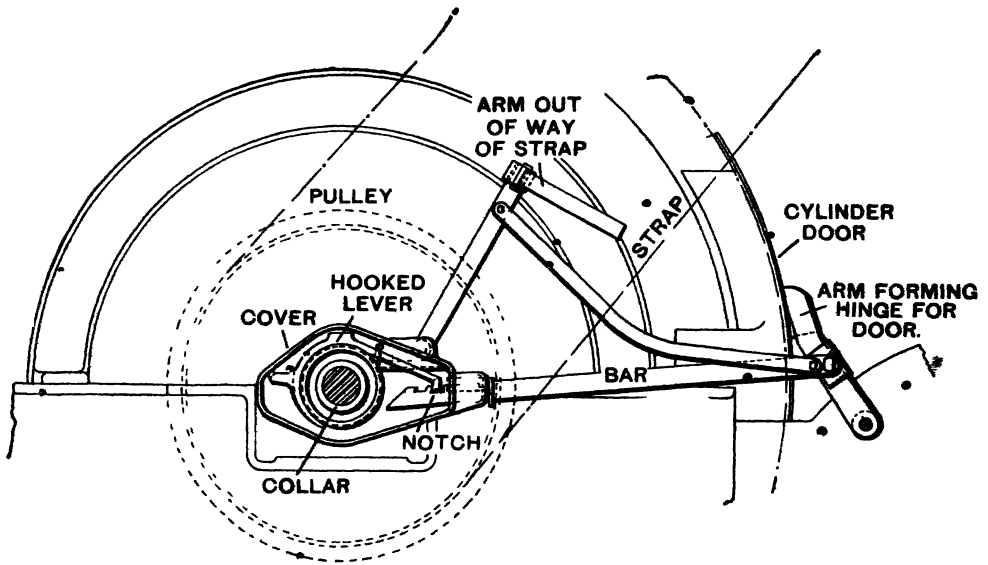
Dia of Cylinder	Dia of Doffer	Dia of Taker in	Width on Wire	Floor Space	
Inches	Inches	Inches	Inches	Ft in Ft in	Metres
50	26	9½	37	10 2 × 5 1	3 101 × 1 55
50	26	9¼	38	10 2 × 5 2	3 101 × 1 57
50	26	9⅜	39	10 2 × 5 3	3 101 × 1 60
50	26	9⅜	40	10 2 × 5 4	3 101 × 1 62
50	26	9¼	41	10 2 × 5 5	3 101 × 1,65
50	26	9½	45	10 2 × 5 10	3 101 × 1 78

"To determine hand of machine stand at the feed end and note on which side the driving pulleys are to be placed

We supply free of charge, with each card the following changes, including those on the machine — 3 barrow or doffer wheels 3 side shaft or feed wheels



MAKING UP PIECE BETWEEN FLATS AND ROLLERS.



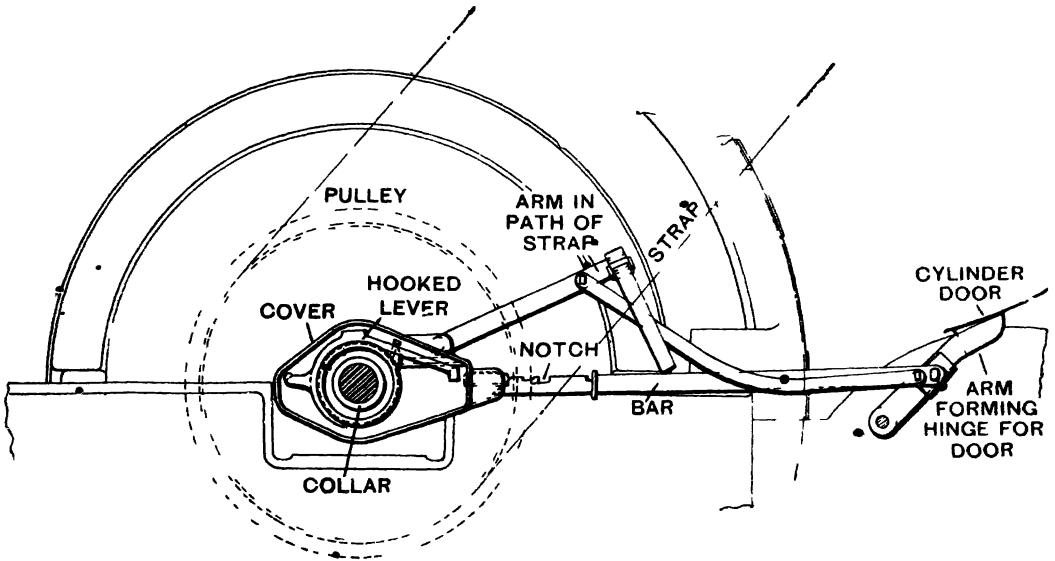
DOOR LOCKING ARRANGEMENT FOR CARDING ENGINE, SHEWING DOOR CLOSED.

IMPROVED DOOR LOCKING ARRANGEMENT FOR CARDING ENGINES.

As is well known, the object of Locking Arrangements on the cylinder doors of carding engines is to prevent the door from being opened until the cylinder has ceased to revolve, and also to prevent the carding engine from being set in motion until the door has been closed.

By the use of the arrangement shown in the accompanying illustrations (pages 84 and 86) both these essential objects of a Locking Motion are attained, and although these illustrations are practically self-explanatory, it would perhaps be desirable to add a description and explanation of the working parts.

A collar is secured on the shaft of the main cylinder, between the fast pulley and the framing of the carding engine. A lever, the end of which is turned down in the form of a hook, is attached to the collar. Supported at one end by a bearing is a bar, the opposite end of which is attached to the arm carrying the cylinder door, this arm being the hinge on which the door works. There is also a strap arm worked directly from the door, which, when the door is open, prevents the strap from being placed on the fast pulley.



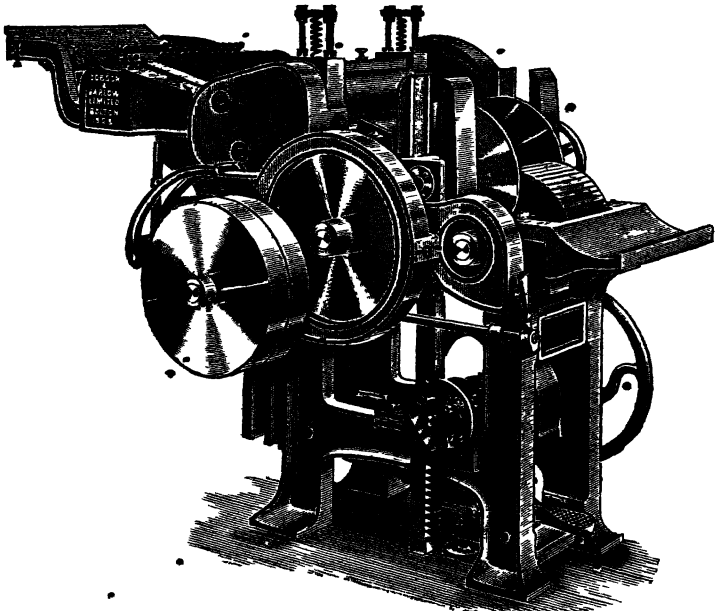
DOOR LOCKING ARRANGEMENT FOR CARDING ENGINE, SHEWING DOOR OPEN.

Improved Door Locking Arrangement for Carding Engines.

While the cylinder is revolving the collar drives the lever until the hook is depressed into the notch of the bar and thus holds the door locked, the strap arm being held free of and above the strap. Immediately the cylinder has ceased to revolve, then, on account of the frictional resistance of the lever, which surrounds the collar, being discontinued, the hook of the lever may be disconnected from the notched bar, which may then be drawn back and the door opened.

As will be noticed, the notched bar is connected to an arm, the free end of which is clear of the strap when the cylinder door is closed, but when the door is open the free end is brought into such a position that it blocks the way of the strap and effectually prevents its being moved on the fast pulley again until the door has been closed.

When the door has been closed and the cylinder commences to revolve, the rotary movement of the shaft causes the hook of the lever to fall into the notch of the bar and thereby locks the door.



SLIVER LAP MACHINE WITH STOP MOTION AND SLIVER PLATE.

SLIVER LAP MACHINE WITH SLIVER PLATE.

SPECIALITIES AND IMPROVEMENTS.

This machine unites the slivers from the carding engine, and forms them into a lap for the comber or for the combined draw and ribbon lap machine when the latter is used.

From 14 to 20 cans are usually put up at this machine, and the laps made are from 7½ in. to 10½ in. wide when taken direct to the comber. But when a ribbon lapper is used they are from 1 in. to 1½ in. narrower to allow for spreading in the drawing.

In order to produce uniform laps a stop-motion is applied to each sliver which instantly stops the machine when an end breaks.

The slivers pass through guides and between three lines of rollers, having a small amount of draft. They then pass between calender rollers, which slightly press the fibres and form them into a fleece to be wound upon a bobbin driven by revolving plates.

When the ribbon lapper is not used the slivers are taken from the card and put through one process of drawing in a drawing frame, after which they go to the sliver lap machine to be made into a lap for the comber. In the latter case four lines of rollers are recommended.

NOTES.

Power.—½ m.h.p.

Production.—450 to 500 lbs. per day.

Speed.—Driving pulley, 16 in. × 2½ in.; 200 revs. per minute.

Floor Space.—18 ends, 8 ft. 0 in. × 4 ft. 6 in. = 2,44 m. × 1,37 m.

Approximate Weight.—Gross, 23 cwts.; net, 19 cwts.

Approximate Cubic Measurement.—65 ft.

Strapping Required.—Line shaft to machine, 27 ft. × 2½ in.

To determine hand of machine, stand at the feed end and note on which side the driving pulleys are to be placed.

SLIVER LAP MACHINE WITH A TABLE.

Sliver Lap Machine.

WITH ⩾ TABLE.

SPECIALITIES AND IMPROVEMENTS.

This machine unites the slivers from the carding engine and forms them into a lap for the comber or for the combined draw and ribbon lap machine when the latter is used.

Any number of cans can be put up at this machine, and the laps made are from 7½ in. to 10½ in. wide when taken direct to the comber. But when a ribbon lapper is used they are from 1 in. to 1½ in. narrower to allow for spreading in the drawing.

In order to produce uniform laps a stop motion is applied to each sliver which instantly stops the machine when an end breaks. Single preventer top roller applied to side calender rollers.

The slivers pass through guides, and between three lines of rollers, having a small amount of draft. They then pass between calender rollers which slightly press the fibres and form them into a fleece to be wound upon a bobbin driven by revolving plates.

When the ribbon lapper is not used the slivers are taken from the card and put through one process of ordinary drawing, after which they go to the sliver lap machine to be made into a lap for the comber. In the latter case four lines of rollers are recommended.

NOTES.

Power.—½ m.h.p.

Production.—450 to 500 lbs. per day.

Speed.—Driving pulley, 9 in. × 1¾ in., 500 revs. per minute.

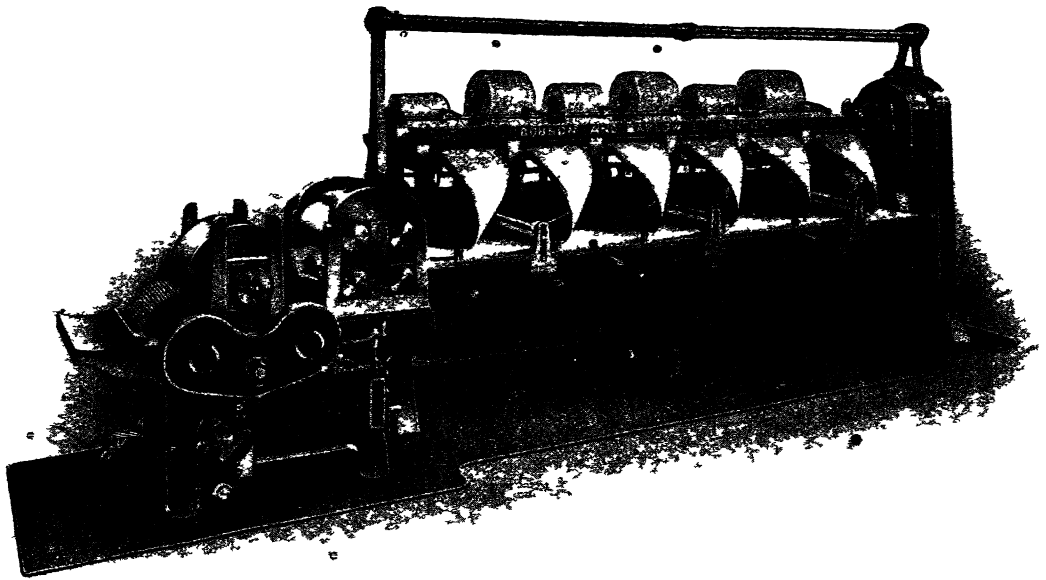
Floor Space.—18 ends, 8 ft. 6 in. × 5 ft. 4 in. = 2,590m. × 1,626m.
20 ends, 9ft. 6½in. × 5ft. 4in. = 2,908m. × 1,626m.

Approximate Weight.—Gross, 33 cwts.; net, 25 cwts.

Approximate Cubic Measurement.—117 ft.

Strapping.—28 ft. × 1½ in.

To determine hand of machine, stand at the feed end and note on which side the driving pulleys are to be placed.



DRAW FRAME AND LAP MACHINE COMBINED

DRAW AND LAP MACHINE.

In re-designing the machine, the greatest care has been exercised in obtaining absolute accuracy of detail, and wherever possible, the various parts are machine tooled, and constructed to template, so that there need not be any fear about the parts fitting together nicely and evenly.

It is very desirable that the machine should be absolutely rigid, and to achieve this we have arranged the frame end at the driving end of a similar pattern to that on the fly frame, the driving wheels being carried inside the body of the frame end, the panels of which act as a first class guard for the wheels.

The design of the roller stands and lap carrier brackets has been improved. Further, the machine generally is so arranged that the laps can be placed in position either from the back or the front.

The stop motions, which are quite positive in their action both in regard to the lap at the back running out and the motion to act when the required diameter of lap has been made by the machine, are a great improvement upon what we previously supplied.

The front curved plates are made of steel stampings of an improved design, and the Tables are also made of steel. The Calender Rollers on the table are driven positively by gearing with the wheels on the inside of the frame, whilst the driving shaft is at the back of the machine, quite clear of the roller weights, and same is cased in.

At the lap end are two pairs of 6 in. Calender Rollers driven positively by gearing, and running in BALL BEARINGS, the weighting being obtained by means of a lever arrangement with sliding weight.

The lap spindle also runs in BALL BEARINGS, and is furnished with a patent LOCKING DEVICE which is the acme of simplicity, as well as being perfectly effective in its action, thus dispensing entirely with the troublesome worm and nut.

The Brake is of a specially improved design, consisting of a steel band, and connected with the brake lever is a compensating motion, which automatically reduces the amount of "brake" on the lap as the same increases in diameter.

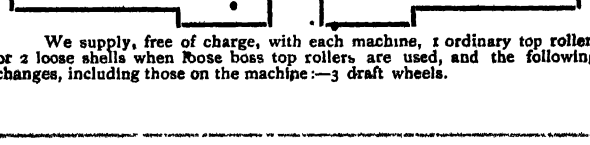
Where requisite, the gearing consists of cut wheels, which are perfectly guarded, and the machine runs sweetly, easily, and silently.

If desired, a WEIGHT LIFTING MOTION can be applied to each delivery, although this is not supplied unless specially ordered.

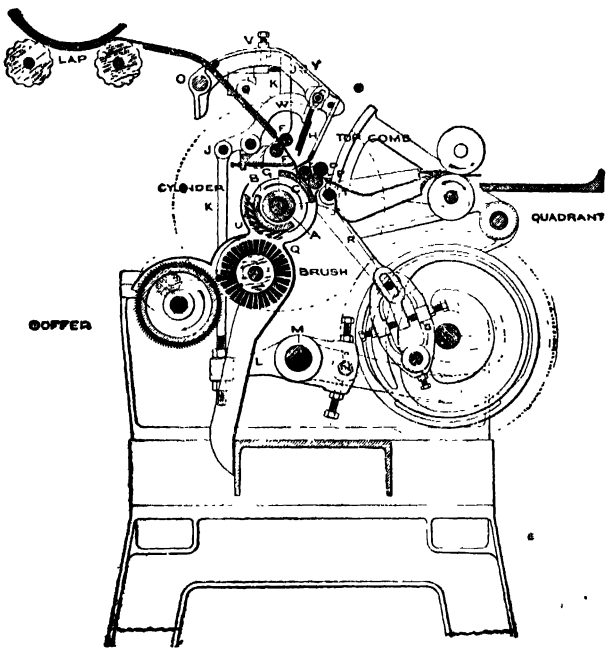
NOTES.

Power.—1 m.h.p.
Production—450 to 500 lbs. per day, according to class of cotton.
Speed.—Driving pulley, 14 in. × 3 in.; 262 revs. per minute.
Floor Space.—14 ft. 6 in. × 4 ft 6 in. — 4,42 m. × 1,372 m.
Approx. Weights.—Machine without weights, gross, 43 cwts.; net, 32½ cwts.; appox. cubic measurement, 140 ft.
Approx. weights only, gross, 9½ cwts., net, 9 cwts.; approx. cubic measurement, 6 ft.
Strapping required.—Line shaft to machine, 27 ft. × 3in.

To determine hand of machine, see sketch below:



We supply, free of charge, with each machine, 1 ordinary top roller, or 2 loose shells when loose boss top rollers are used, and the following changes, including those on the machine:—3 draft wheels.

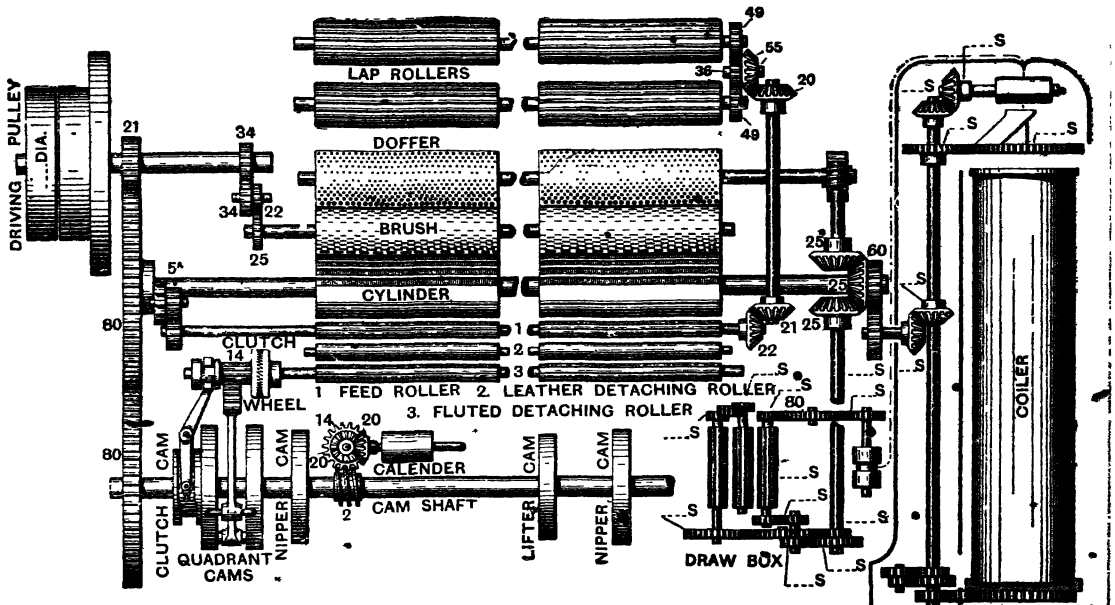


SECTION OF SINGLE NIP COMBING MACHINE.

SINGLE NIP COMBING MACHINE.

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

A Cylinder shaft.
B Half lap.
C Fluted segment.
DD Fluted detaching rollers.
E Leather detaching roller.
FF Feed rollers.
G Cushion plate.
H Nipper knife.
I Nipper arm fulcrum
K Upright connecting rod for nipper.
L Nipper shaft lever.
M Nipper shaft.
N Lever for nipper cam.
O Top comb centre.
P Loose clutch wheel.
Q Cylinder casing.
R Long lifter.
S Ring for long lifter.
T Long lifter shaft.
U Brush casing.
V Top comb setting screw
W Nipper frame centre.
X Quadrant bowl or runner.
Y Nipper setting screw.



GEARING PLAN OF COMBING MACHINE.

Combing Machines.

NOTES

Power—Single Nip 6 heads, $\frac{5}{8}$ m.h p.; 8 heads, $\frac{7}{8}$ m.h.p

Pulleys—Single Nip Comber, 12 in × 3 in

Speeds—Single Nip Comber, 305 revs, 80 nips.

Strapping Required—Line shaft to machine, 22 ft × 2½ in.

SPACE OCCUPIED

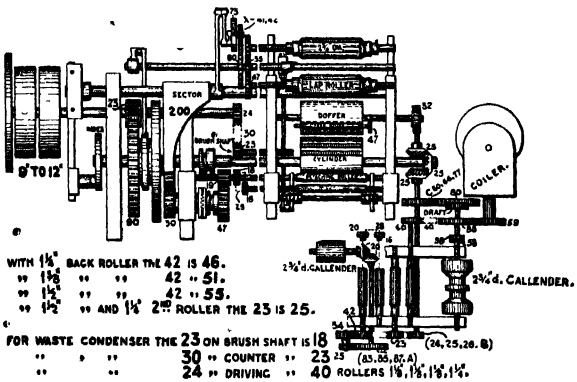
	7½in and 8½in Laps	9in Laps	10½ in Laps	Width
8 heads	15 ft 5 in 4 775m long	16 ft 0 in 4 877m long	17 ft 0 in = 5 182m long	3 ft 5 in = 1 042m wide
6 "	12 ft 9½ in = 3 873m long	12 ft 11½in 3 950m long	13 ft 8½ in 4,178m long	3 ft 5 in = 1,042m wide

PRODUCTION OF SINGLE NIP COMBER PER HEAD IN 10 HOURS.

No of Nips per minute	Weight of Lap per yard	Width of Lap	Waste per cent	Lbs per Head of Combed Sliver	Kind of Cotton Worked
	dwts	Inches			
80	8	7½	20	6 37	Sea Islands
80	9	8½	20	7 22	
80	11	10½	20	8 92	
80	9	7½	18	7 5	Egyptian or American
80	10½	8½	18	9 0	
80	13	10½	18	11 15	

The above productions are based upon a speed of 80 nips per minute, but we have machines running up to 95 nips per minute for Egyptian cotton.

COMBING MACHINE - NASMITH'S PRINCIPLE.



PLAN OF CEARING.

COMBING MACHINE.

NASMITH'S PRINCIPLE.

Five important advantages:

1. The time available for detaching and drawing through the top comb is greatly prolonged.

2. The top roller is as easily set as a drawing head roller, doing away with any delicate adjustment.

3. No definite and fixed surface speed of the roller is imposed and a smooth cam takes the place of the abrupt notch wheel cam.

4. The shock and deflection of the leather roller dropping on the cylinder under the influence of weights is done away with, and a 25-pound weight easily works a 10½-inch lap of 600 or 700 grains per yard.

5. A long overlap and perfect piecing are obtained even with ⅞-inch staple.

Weight of Laps 10½-inches wide. (Narrower laps proportionately lighter).

For Superfine Sea Island,	12 to 18 dwts per yard.
For Florida cottons,	18 to 22 ,, ,,
For Egyptian and American cottons,	22 to 32 ,, ,,

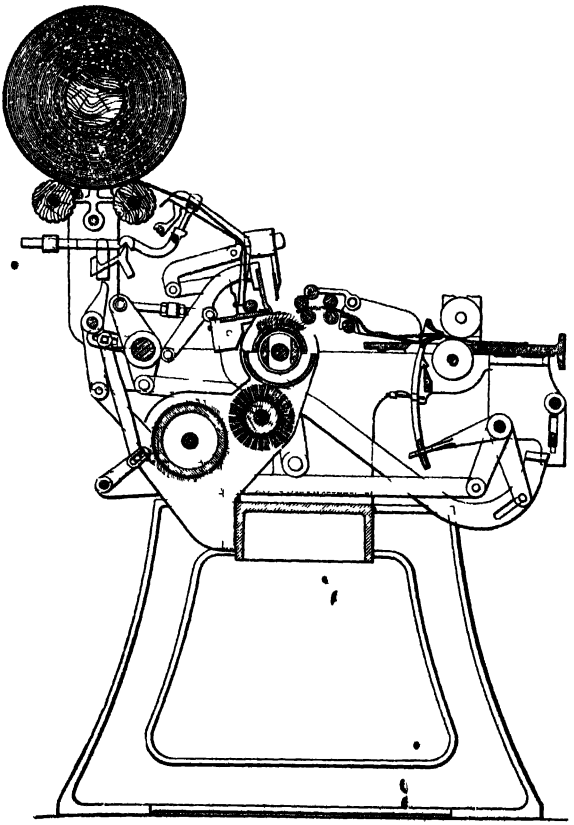
Pulleys and Speeds. 10-inch pulleys are supplied with the machine unless ordered larger. They may make

335 Revolutions (86 nips) for Finest Sea Island.
350 ,, (90 ,,) ,, Florida Cottons.
370 ,, (95 ,,) ,, Egyptian and Best American.
390 ,, (100 ,,) ,, Coarse Work.

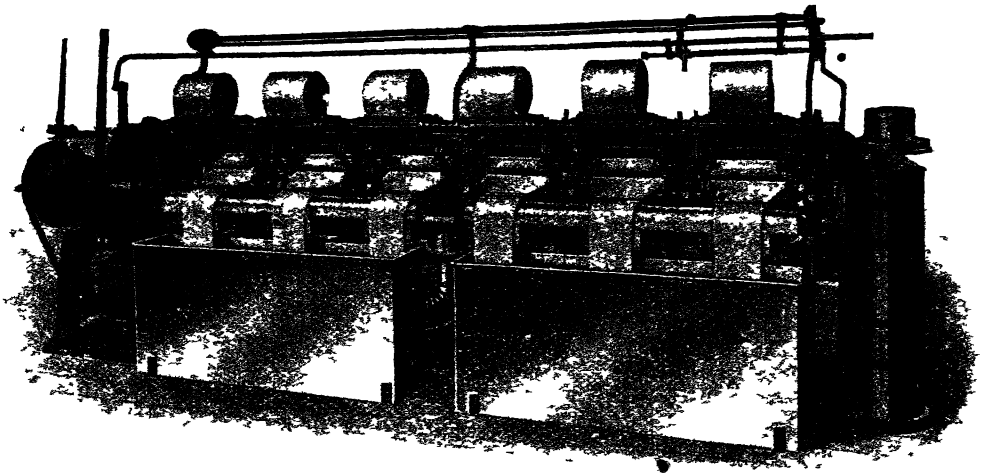
Dimensions and Weights.

	Length.	Width.	(Approximate Weight). Gross.	Net.
4 Heads 10½ in. lap.	10 ft. 11 in.	3 ft. 5 in.	37 cwts.	28 cwts.
5 ,, ,, ,,	12 ft. 7 in.	3 ft. 5 in.	42 cwts.	32½ cwts.
6 ,, ,, ,,	14 ft. 3 in.	3 ft. 5 in.	47 cwts.	37 cwts.

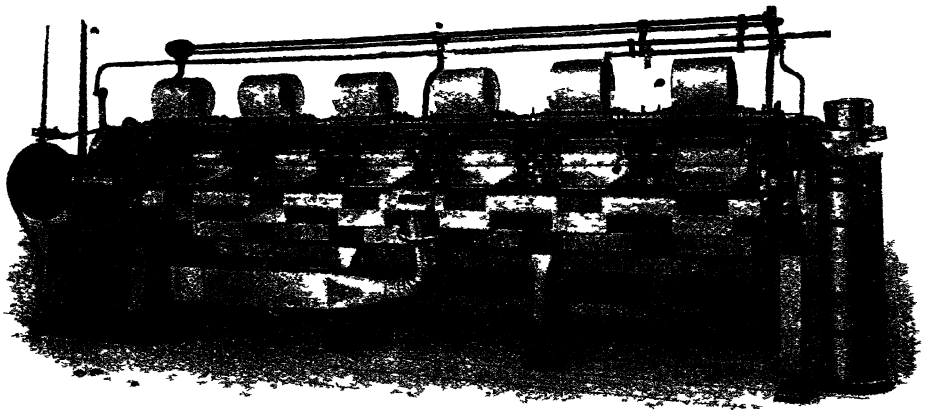
COMBING MACHINE—NASMITH'S PRINCIPLE.



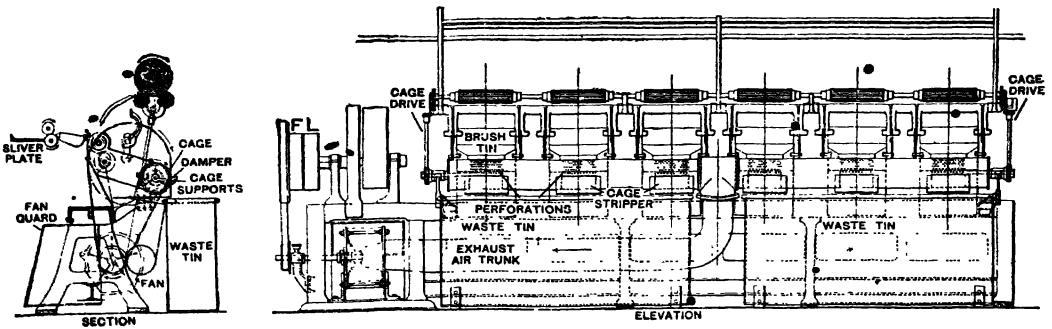
SECTION



ROTH'S PATENT ASPIRATOR, SHEWING WASTE TINS IN POSITION



ROTH S PATENT ASPIRATOR WITHOUT WASTE TINS

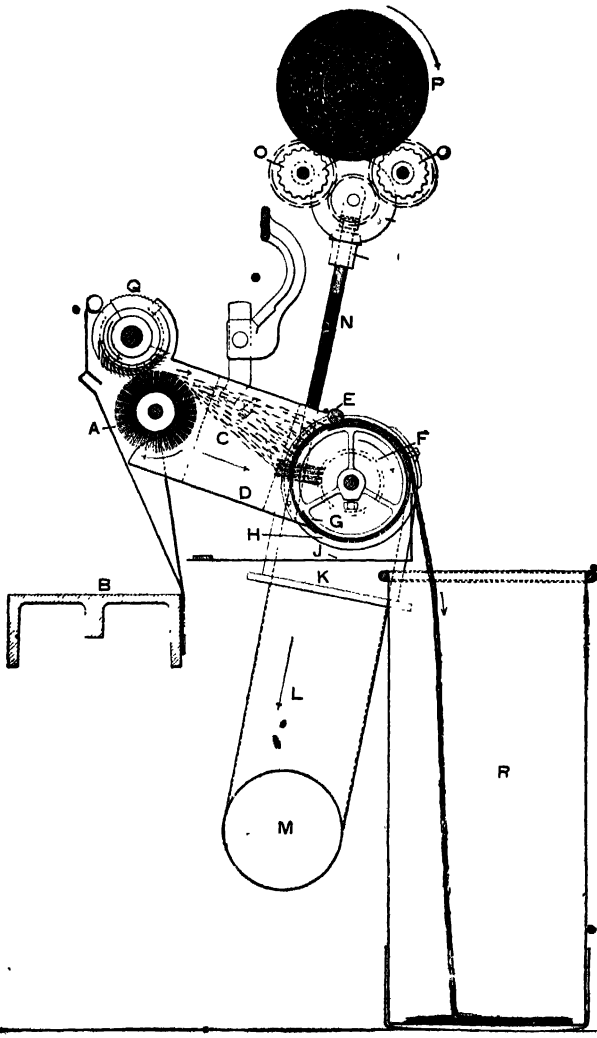


BACK ELEVATION AND SECTION OF COMBING MACHINE, SHEWING THE WASTE ASPIRATOR IN POSITION.

IMPORTANT IMPROVEMENT IN HEILMANN COMBERS.

The "HEILMANN" COMBER, so indispensable in the preparation of long staple cotton, has of late been the subject of much attention on the part of inventors. Strenuous efforts have been put forth to increase its productive capacity, and at the same time to maintain the high quality of output that characterises the working of the machine. Much good must accrue from the attainment of these objects, and it is accordingly the desire of all connected with the cotton industry that these efforts may be successful. While the experiments are in progress, however, the question of dealing more effectively with the waste thrown off by the machine should not be overlooked; for it would appear that in this regard there was room for considerable improvement, hence the invention under notice.

Those familiar with the working of the "Heilmann" machine will understand that, as it is at present constructed, the waste is removed from the combing cylinder by means of a revolving brush, from which it is taken by a doffer. A stripping comb collects the short fibres from the



SECTION THROUGH COMBING MACHINE SHEWING WASTE ASPIRATOR IN POSITION

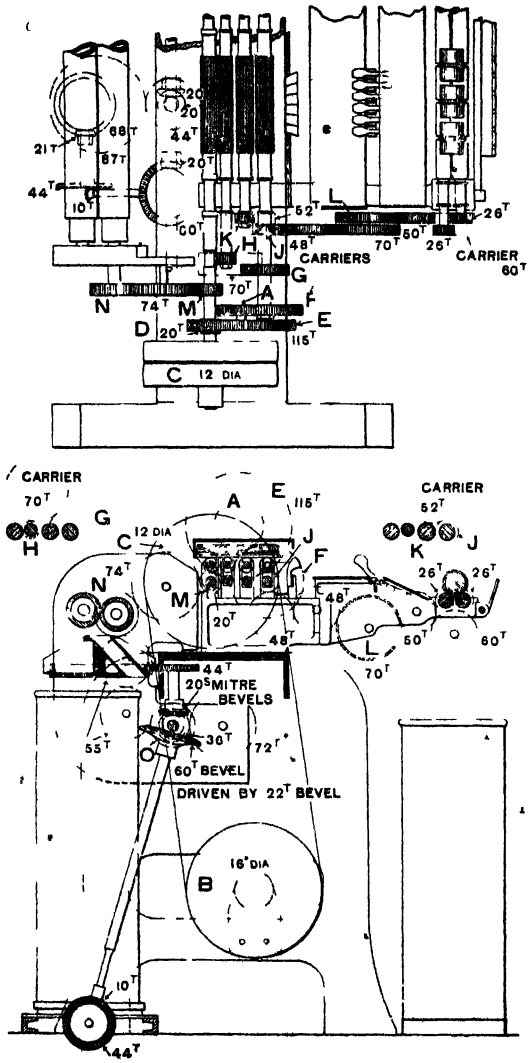
doffer, and finally discharges this waste into a suitable receptacle. This method of procedure has its disadvantages; for, in transferring the waste from the brush to the doffer, the material is liable to become "neppy," thereby reducing its value as a commercial article. It may be further noticed that as the doffer only removes the waste from the surface of the brush, and as the material taken off is very fine and light, it is easily carried about the machine by air currents, and settles about the parts, thus clogging and necessitating frequent cleaning.

In the invention to which we direct attention, the doffer and the stripping comb are dispensed with, and the removal of the waste is effected by means of a strong current of air. The arrangement of the combing cylinders and brushes remains as before, but the brushes are enclosed in casings which also extend partly round the combing cylinder of each head. These casings have communication with a cylindrical filtering screen which extends the whole length of the machine, from the centre of which it has further communication with the forced draught apparatus.

Within the cylindrical screen is mounted a fixed shield to each head, which covers about two-thirds of its interior, while the remaining third is exposed to the air current.

It is on this part only that the waste is collected, the remaining two-thirds being inoperative. As the cylindrical screen rotates, however, the waste, which is pressed by the air current against the operative portion, is carried down to the inoperative portion, where the pressure of air ceases. The waste, having been partly consolidated by the pressure of air, passes between a small roller and the revolving screen, and falls away into a box, or other receptacle, in the form of a fleece The waste is free from nep, and as a marketable article is considered much better than the waste delivered under former conditions.

There is also an entire absence of fly of fluffy cotton about the machine; a fact that of itself adds merit to the invention, and effects a great saving in the time hitherto devoted to the cleaning of the machine.



GEARING PLAN OF DRAWING FRAME.

Drawing Frame.

No of Frames	No of Heads in each
4 Lines of Rollers	No of Deliveries to each Head
Dia of Front Bottom Roller	Ditto Top Roller uncovered
Second	"
Third	" "
" Fourth	" "
Distance from centre to centre of Stands	
Slivers per Delivery	Dia of Main pulley on Frame
One Dead Weight for each Roller	pounds
Revs of Main Shaft per minute	Dia of Drum on same
Revs of Front Roller per minute	Dia of Cans
Length of Cans	kind of Cotton to be worked

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE

A Draft wheel
B Intermediate driving pulley
C Front roller driving pulley fast and loose
D Front roller wheel
E Chased boss carrier
F Back roller wheel
G Back roller wheel driving 2nd roller through 70's carrier
H 2nd roller wheel
J Back roller wheel driving 3rd roller through 52's carrier
K 3rd roller wheel
L Draft wheel for single preventer rollers
M Front roller wheel driving calenders and coilers
N Calender roller wheel
O Coiler driving shaft wheel

CALCULATIONS

Draft between front and back rollers —

$$\frac{L \times F \times \text{Dia of Front Roller}}{D \times A \times \text{Dia of Back Roller}}$$

To find the change wheel A

(A in the above formula is the change wheel so by substituting any given draft in place of A the result will give the change wheel required for that draft)

$$\frac{I \times F \times \text{Dia of Front Roller}}{D \times \text{Draft} \times \text{Dia of Back Roller}}$$

Draft between second and back rollers

$$\frac{G \times \text{Dia of 2nd roller}}{H \times \text{Dia of Back Roller}}$$

Draft between third and back rollers —

$$\frac{J \times \text{Dia of 3rd Roller}}{K \times \text{Dia of Back Roller}}$$

Draft between the first and second rollers

$$\frac{\text{Total Draft}}{\text{Draft between fourth and second roller}}$$

$$\text{Weight of Drawing} = \frac{\text{Number of Ends} \times \text{Weight of Carding}}{\text{Draft}}$$

$$\text{Draft} = \frac{\text{Number of Ends} \times \text{Weight of Carding}}{\text{Weight of Drawing}}$$

$$\text{Change Pinion} = \frac{\text{Required Weight} \times \text{Change Pinion on}}{\text{Present Weight}}$$

$$\text{Change Pinion} = \frac{\text{Change Pinion} \times \text{Present Hank}}{\text{Required Hank}}$$

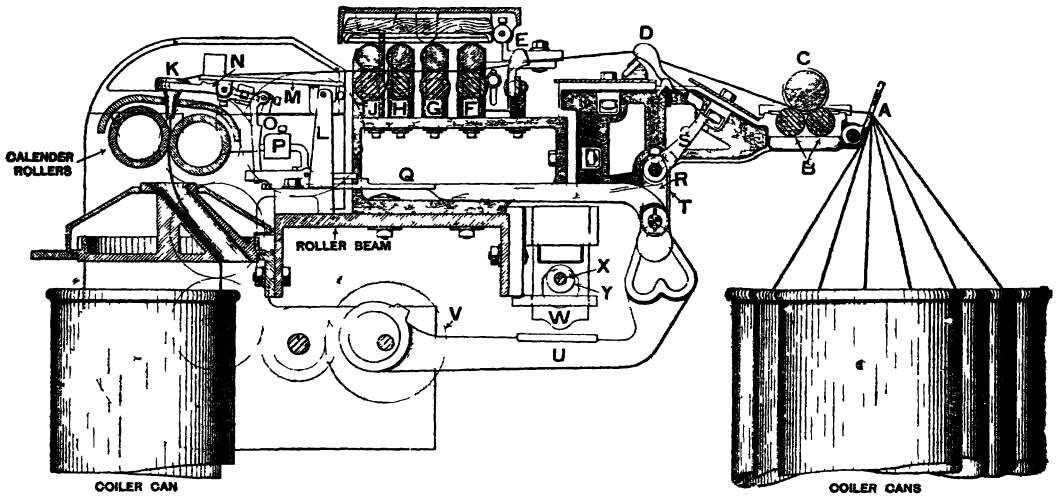
NOTES

Power —1 m h p for 12 deliveries

Production —Per day of 10 hours per finishing delivery —

Indian Cotton	160 to 177 lbs	According to quality of cotton
Russian and American Cotton	124 to 159 "	
Egyptian Cotton	62 to 120 "	
Sea Islands Cotton	39 to 62 "	

Drawing Pulley —18 in × 3 in



SECTON OF DRAWING FRAME.

Drawing Frames.

REFERENCES TO ILLUSTRATION ON PRECEDING PAGE.

A Back swivel sliver guide.
B Bottom single preventer rollers.
C Top ,, ,, ,,
D Spoon with adjustable stop.
E Back traverse guide (either finger or horn shape).
F, G, H, J Bottom drawing rollers.
K Funnel for front stop motion.
L Main fixing for front stop motion.
M Cover plate for front stop motion.
N Weighted lever for K.
O Swivel pendulum link.
P Weighted lever for regulating stop motion for heavy slivers.
Q Reciprocating bar for stopping rocking shaft.
R Rocking lever for Q.
S Rocking plate for spoon D.
T Gearing end rocking lever.
U Eccentric arm with double V slot
V ,, wheel
W Pistol actuated by U.
X Setting-on and stop rod.
Y Bush for moving strap fork on to loose pulley when released by W.

USUAL WEIGHTS FOR DRAWING FRAME ROLLERS.

	Front.	2nd.	3rd.	Back.
Indian and American Cotton..	20lbs.	20lbs.	20lbs.	20lbs.
Egyptian Cotton.....	18 ,,	18 ,,	18 ,,	18 ,,
Sea Islands Cotton	16 ,,	16 ,,	16 ,,	16 ,,

Drawing Frames.

Approximate Weights and Cubic Measurements.

Heads	Deliveries	Without Weight		Roller and other weights if supplied		Cubic Measurement	
		Gross	Net	Gross	Net	Without weights	Weights only
		Cwts	Cwts	Cwts	Cwts	Feet	Feet
1 ..	3 each	21	16	5	4½	70	4
2 ..	3 ,,	39	30	9½	8¼	133	6
3 ..	3 ,,	57	43	13½	13	195	9
1 ..	4	24	19	6½	5¼	82	5
2 ..	4	46	37	12½	11½	154	8
3 ..	4 ,,	68	54	18¼	17¼	225	12
1 ..	5 ,,	28	22	8	7¼	95	6
2 ..	5 ,,	54	43	15½	14¾	185	10
3 ..	5 ,,	81	64	23	21¼	275	16
1	6 ,,	32	25	9½	8¾	110	6
2 ..	6 ,,	62	49	18½	17¾	207	12
3 ..	6 ,,	93	73	27¼	25¾	310	18
1 ..	7 ,,	36	28	11	10	125	7
2 ..	7 ,,	70	54	21	20	235	15
3 ..	7 ,,	104	80	31½	30	345	21
1 ..	8 ,,	39	31	12½	11½	130	9
2 ..	8 ,,	75	59	24½	23	245	16
3 ..	8 ,,	112	89	36	34½	360	23

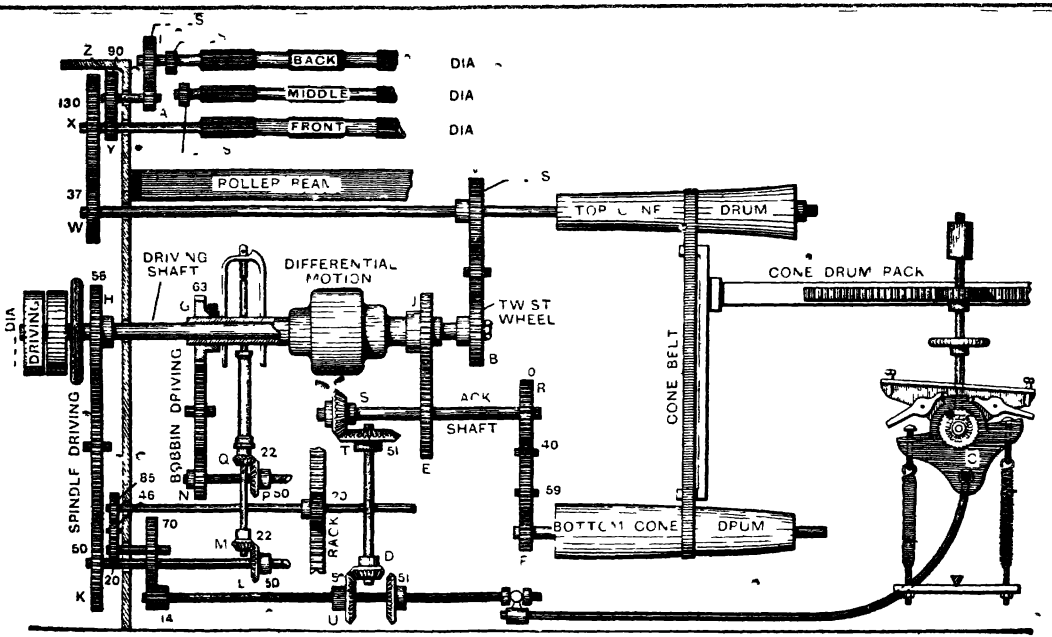
Drawing Frames.

Comparative Speeds.

Intermediate pulley on driving shaft 16 in. dia. × 4 in. wide.

Front roller pulley, driven by above pulley, 12 in. dia. × 2 in wide.

Driving Shaft, revs. per min	Front Roller, revs. per min.	Driving Shaft, revs. per min.	Front Roller, revs. per min.	Driving Shaft, revs per min.	Front Roller, revs. per min.
150	200	205	273⅓	260	346⅔
155	206⅔	210	280	265	353⅓
160	213⅓	215	286⅔	270	360
165	220	220	293⅓	275	366⅔
170	226⅔	225	300	280	373⅓
175	233⅓	230	306⅔	285	380
180	240	235	313⅓	290	386⅔
185	246⅔	240	320	295	393⅓
190	253⅓	245	326⅔	300	400
195	260	250	333⅓		
200	266⅔	255	340		



GEARING PLAN OF FLY FRAME, SHEWING PATENT DIFFERENTIAL MOTION.

Fly Frames.

No. of Frames ..... Space of Spindles ....

No. of Spindles..... ..... Dia. of ditto .....

Lift of Bobbin .... Dia. of the Barrel of the Bobbin. ....

Dia. of Bobbin when full . ..... Bobbin to lead.

Spindles to run . .....Weft way .. .. or .....Twist way ....

Collars--long..... . short..... ..

3 Lines of Rollers, one Thread per boss.

Dia. of Front Bottom Roller ..... Ditto. Top Roller uncovered .....

„ Middle „ .... „ „ „ .....

„ Back „ ..... „ „ „ .....

Lines of Weights . ... Weight of Weights..... .....

Revs. of Main Shaft per minute ..... Dia. of Drum on same.....

Dia. of Pulley on Frame.. ..... Revs of Spindles per minute. ....

Revs of Spindle for one of Driving Pulley on Frame..... .....

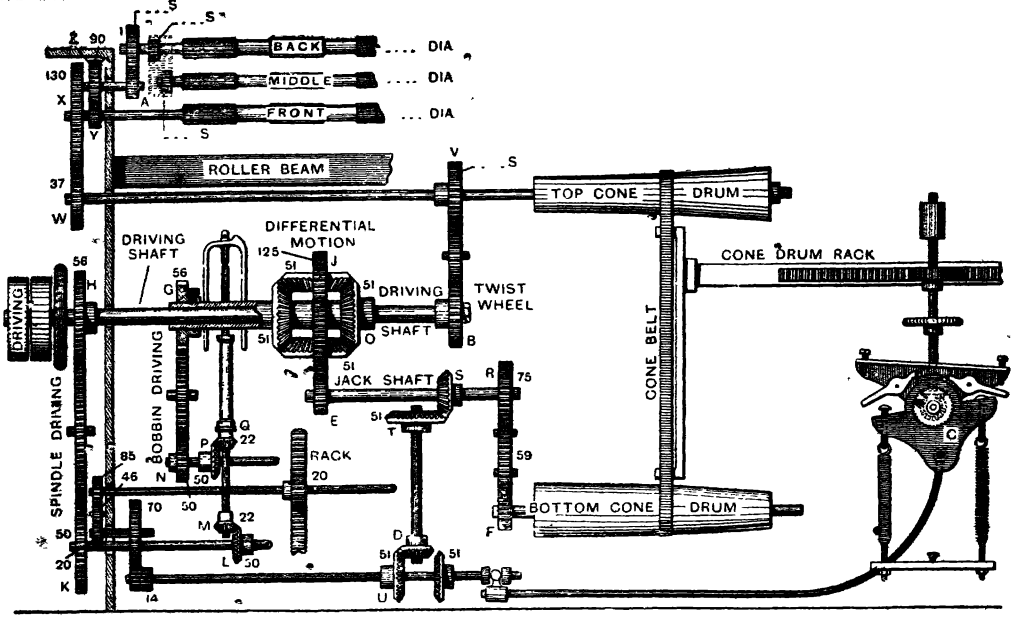
Kind of Cotton to be worked..... .. ..

References to Gearing of Fly Frame, showing our Patent Differential Motion and its Connections.

A Draft wheel.
B Twist wheel.
C Star or ratchet wheel.
D Lifter wheel.
E Cam wheel on jack shaft.
F Bottom cone end wheel.
G Driving wheel for bobbins.
H „ „ „ spindles.
I Back roller wheel.
J Cam wheel.
K Outside spindle wheel.
L Skew gear wheel for spindles.
M Spindle bevel wheel.
N Outside bobbin wheel.
P Skew gear wheel for bobbins.
Q Bobbin bevel wheel.
R Jack shaft wheel.
S Lifter bevel wheel on jack shaft.
T Upright bevel on lifter shaft.
U Strike or lifter bevel wheels.
V Top cone drum wheel.
W „ „ end wheel.
X Large front roller wheel.
Y Small „ „
Z Top carrier wheel.

Change Places.

A	Change for draft.	Wheels, 35 to 60 teeth.	
B	„ twist.	„ 26 „ 50	„
C	„ winding (star wheel).	„ 10 „ 50	„
D	„ traverse (lifter „).	„ 14 „ 28	„
F	Proportional to dia. of empty bobbin (cone wheel)	„ 14 „ 30	„
S	(Change for traverse) Lifter bevel wheel on jack shaft	„ 14 „ 28	„



GEARING PLAN OF FLY FRAME, SHEWING ORDINARY DIFFERENTIAL MOTION.

Fly Frames.

No of Frames	Space of Spindles
No of Spindles	Dia of ditto
Lift of Bobbin	Dia of the Barrel of the Bobbin
Dia of Bobbin when full	Bobbin to lead
Spindles to run Weft way	or Twist way
Collars long short	
3 Lines of Rollers, one Thread per boss or two Threads per boss	
Dia of Front Bottom Roller	Ditt Top Roller uncovered
Middle	
Back	
Lines of Weights	Weight of Weights
Revs of Main Shaft per minute	Dia of Drum on same
Dia of Pulley on Frame	Revs of Spindles per minute
Revs of Spindle for one of Driving Fully on Frame	
Kind of Cotton to be worked	

REFERENCES TO CHANGE FLY FRAME SHOWING OUR ORDINARY DIFFERENTIAL MOTION AND ITS CONNECTIONS

A Draft wheel	O Driving bevel for differential motion
B Twist wheel	P Skew gear wheel for bobbins
C Star or ratchet wheel	Q Bobbin bevel wheel
D Lifter wheel	R Jack shaft wheel
E Jack wheel	S Lifter bevel wheel on jack shaft
F Bottom cone end wheel	T Upright bevel on lifter shaft
G Driving wheel for bobbins	U Strike or lifter bevel wheels
H spindles	V Top cone drum wheel
I Back roller wheel	W end wheel
J Sun wheel	X Large front roller wheel
K Outside spindle wheel	Y Small
L Skew gear wheel for spindles	Z Tip carrier wheel
M Spindle bevel wheel	
N Outside bobbin wheel	

CHANGE PLACE

		Wheels	35 to 60 teeth
A	Change for draft		
B	twist	26	50
C	winding (star wheel)	10	50
D	traverse (lifter)	14	25
E	Proportional to dia of empty bobbin (jack wheel)	15	30
F	Traverse and dia of bobbin (cone wheel)	14	30

Fly Frames.

Calculations.

Speed of front roller $= \frac{\text{Revs. of H} \times \text{B} \times \text{W}}{\text{V} \times \text{X}}$

Speed of spindles $= \frac{\text{Revs. of H} \times \text{H} \times \text{L}}{\text{K} \times \text{M}}$

Length delivered by front roller $= \frac{\text{Revs of B} \times \text{B} \times \text{W} \times \text{dia. of F. R} \times 3{\cdot}1416}{\text{V} \times \text{X}}$

Turns of spindle to one of front roller $= \frac{\text{Speed of spindles}}{\text{Speed of front roller}}$

Turns of spindle to one of front roller $\frac{\text{X} \times \text{V} \times \text{H} \times \text{L}}{\text{W} \times \text{B} \times \text{K} \times \text{M}}$

Twist per inch $= \frac{\text{Speed of spindles}}{\text{Length delivered by front roller}}$

Twist per inch $= \frac{\text{X} \times \text{V} \times \text{H} \times \text{L}}{\text{W} \times \text{B} \times \text{K} \times \text{M} \times \text{dia. of F R.} \times 3{\cdot}1416}$

Twist wheel B $= \frac{\text{X} \times \text{V} \times \text{H} \times \text{L}}{\text{W} \times \text{twist per inch} \times \text{K} \times \text{M} \times \text{dia. of F R.} \times 3{\cdot}1416}$

Constant number for twist $= \frac{\text{X} \times \text{V} \times \text{H} \times \text{L}}{\text{W} \times \text{K} \times \text{M} \times \text{dia of F R.} \times 3{\cdot}1416}$

Twist wheel $= \frac{\text{Constant number}}{\text{Twist per inch required}}$

Twist per inch $= \frac{\text{Constant number}}{\text{Twist wheel}}$

Total draft $= \frac{\text{Dia. of F.R.} \times \text{I} \times \text{Z}}{\text{Dia. of B.R.} \times \text{A} \times \text{Y}}$

Change wheel A $= \frac{\text{Dia. of F R.} \times \text{I} \times \text{Z}}{\text{Dia. of B R} \times \text{required draft} \times \text{Y}}$

Constant number for draft $= \frac{\text{Dia of F.R.} \times \text{I} \times \text{Z}}{\text{Dia. of B.R} \times \text{Y}}$

Change wheel $= \frac{\text{Constant number}}{\text{Draft}}$

Hank roving $= \frac{7{,}000 \times \text{number of yards taken}}{840 \times \text{weight in grains}}$

Fly Frames.

Calculations.

Draft wheel when changing the hank $= \frac{\text{Present hank} \times \text{present change wheel}}{\text{Required hank}}$

Twist wheel B $= \sqrt{\frac{\text{Present twist wheel}^2 \times \text{present hank}}{\text{Required hank}}}$

Lifter wheel D $= \sqrt{\frac{\text{Present lifter wheel}^2 \times \text{present hank}}{\text{Required hank}}}$

Star wheel C $= \sqrt{\frac{\text{Present star wheel}^2 \times \text{hank required}}{\text{Present hank}}}$

Weight per yard of hank roving, in grains $= \frac{7{,}000}{840 \times \text{hank roving}}$

Time in minutes to build bobbin $= \frac{840 \times 36 \times \text{twist per inch} \times \text{hank} \times \text{weight of bobbin in ozs.}}{\text{Revs. of spindles} \times 16}$

No. of sets in 10 hours $= \frac{600 \text{ minutes}}{\text{Minutes to build bobbin + time for doffing, etc}}$

Lbs. per day of 10 hours = Sets in 10 hours × weight of bobbin in lbs

Hanks per day of 10 hours = Lbs. per day × hank roving

Slubbing Frame Wheels.

			Const:
Driving Wheel..	32's	Sea Islands	1·061
Do. ..	40's	Egyptian	1·326
Do. ..	48's	Do.	1·59
Do. ..	56's	Indian and American..... ...	1·856

Intermediate Frame Wheel.

Driving Wheel..	48's	Sea Islands and Egyptian	1·71
Do. ..	56's	Indian and American	1·994
Do. ..	64's	Do. Do.	2 27

Roving and Jack Frames.

Driving Wheel..	56's	Indian, American, Egyptian and Sea Islands	2·545
Do. ..	64's	Do. Do.	2·9

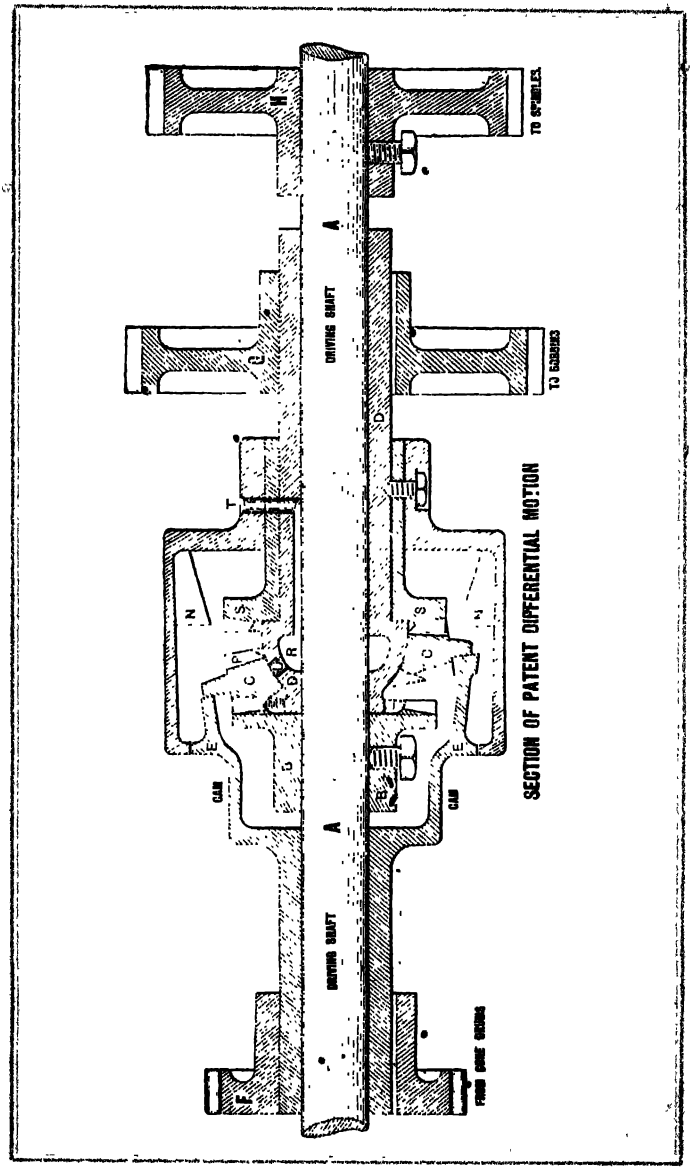
Example.—Speed of Spindle × Constant to suit driving wheel = Speed of frame shaft.

Notes.

Power.—Slubbing frame . 90 spindles, 8 in. space, 2 m.h.p.
Intermediate „ 120 „ 6½ in. „ 2 „
Roving „ 150 „ 5½ in. „ 2 „
Jack „ 200 „ 4½ in. „ 2 „

Driving Pulley.—12 in. to 16 in. dia. × 3in wide.

Space Occupied.—Multiply half the number of spindles in the machine by the space of the spindles, and add 3 ft. 0 in., or 0,914m., for gearing, etc., for single driven frames, and 5 ft. 1 in., or 1,548 in., for frames driven at each end. Width of frames: Slubbing, 5 ft., or 1,523 m., including cans; intermediate, 3 ft. 2 in., or 0,965 m; roving and jack frames, 3 ft.. or 0,914 m."


DRIVING SHAFT
DRIVING SHAFT
CAM
CAM
TO SPINDLES
TO BOBBINS
SECTION OF PATENT DIFFERENTIAL MOTION

PATENT DIFFERENTIAL MOTION.

A Driving shaft.
B Bevel wheel fixed on shaft A.
C Oscillating bevel wheel, mounted on spherical bearing, and gearing into B on one side and into bevel wheel S on the other side.
D Spherical bearing with long collar running loosely in the same direction on shaft A.
E Cam with inclined surface, bearing against the rim of bevel wheel C, and driven from bottom cone through jack shaft and spur wheel F.
F Spur wheel mounted on boss of inclined cam E and driving same.
G Bobbin driving wheel mounted on boss of spherical bearing D.
H Spindle driving wheel, secured to driving shaft and positively driven
N Projections for distributing the oil.
P Teeth on oscillating bevel wheel C.
R Enlarged oil chamber.
S Bevel wheel fixed to spherical bearing and gearing with oscillating bevel wheel C.
T Oil inlet.
U Oil passage to spherical bearing.

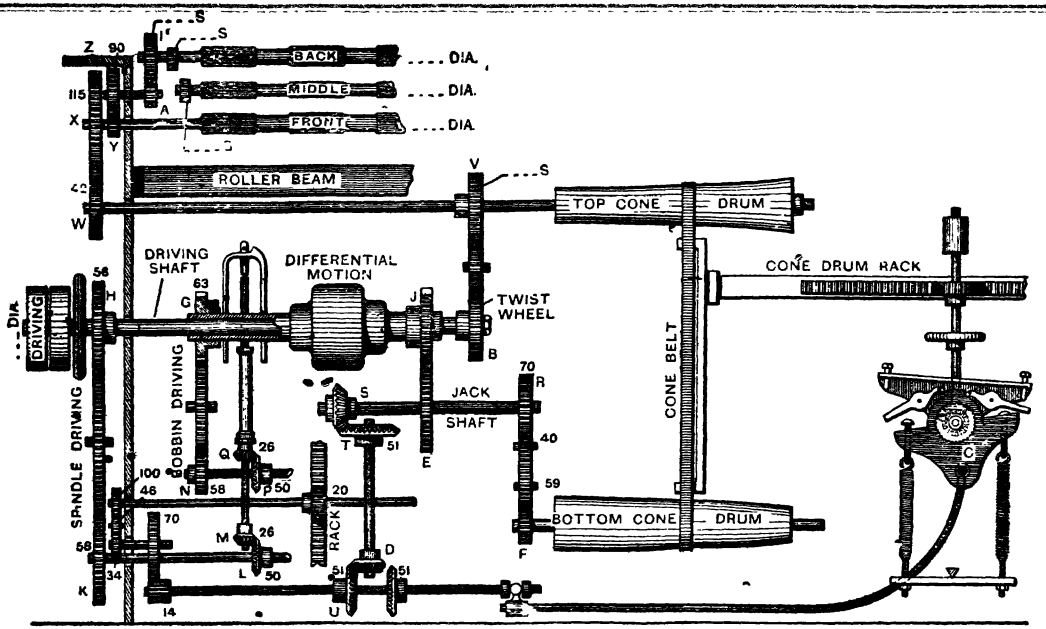
The essential features of our patent differential motion are as follows:—

Its compactness, being self-contained and encased in a polished shell, which in outward appearance resembles an ordinary shaft coupling.

Perfect lubrication, the oil enters at T directly to the driving shaft, and after flowing into the chamber R, passes through U and lubricates the spherical bearing D and bevel wheel C The oil also lubricates the inclined surface of E. The centrifugal action of the motion causes the oil to constantly circulate throughout the bearings while at work, and is equally distributed by means of the projections N.

The motion is protected from dirt by means of a casing and the cam E, which at the same time prevent the oil from flying outwards.

The gearing being thoroughly immersed in oil, little power is required to drive it.



GEARING PLAN OF SLUBBING FRAME

COMPARATIVE SPEEDS OF DRIVING SHAFT AND SPINDLES.

SLUBBING FRAMES.

The wheel on driving shaft which drives the spindles = 56.

Driving Shaft, Revs. per minute.	Spindles, Revs. per minute	Driving Shaft. Revs. per minute.	Spindles, Revs. per minute.	Driving Shaft, Revs. per minute.	Spindles, Revs. per minute.
200	371·35	235	436 34	270	501 32
205	380·63	240	445 62	275	510 61
210	389 92	245	454·90	280	519·89
215	399·20	250	464·19	285	529·17
220	408 48	255	473 47	290	538·46
225	417·77	260	482·75	295	547 74
230	427·05	265	492·04	300	557 03

INTERMEDIATE FRAMES.

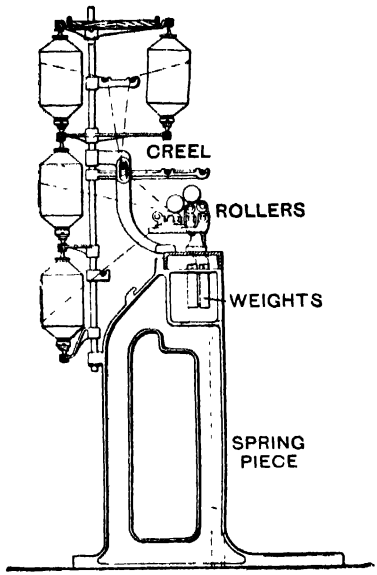
The wheel on driving shaft which drives the spindles = 56.

300	598·29	330	658·12	360	717·94
305	608·26	335	668 09	365	727 92
310	618·23	340	678 06	370	737 89
315	628·20	345	688 03	375	747·86
320	638·17	350	698·00	380	757·83
325	648·14	355	707 97	385	767 80

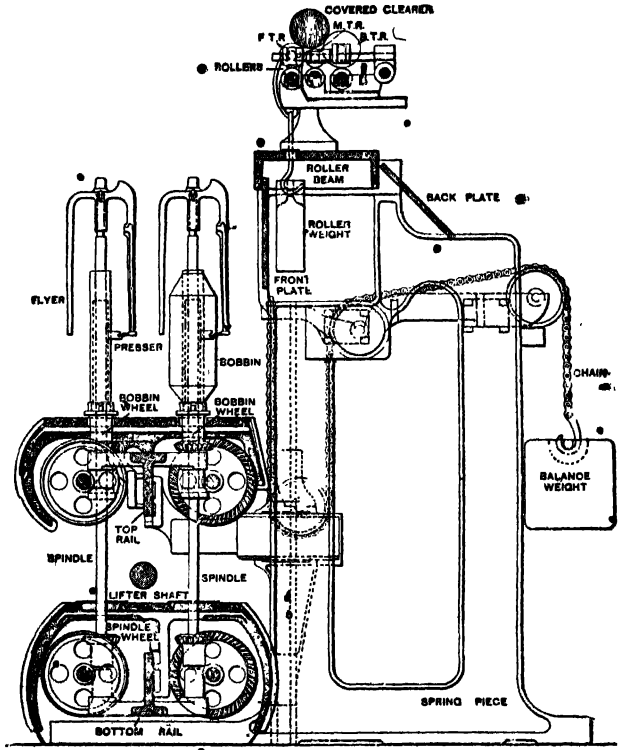
ROVING AND JACK FRAMES.

The wheel on driving shaft which drives the spindles = 56.

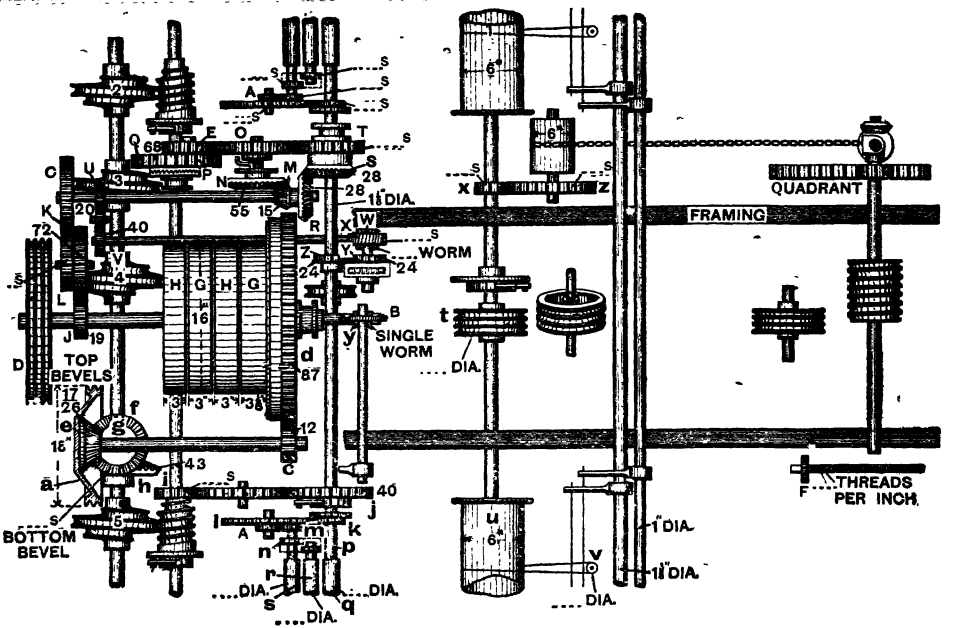
310	789 09	360	916 36	410	1043·63
315	801 81	365	927·09	415	1056·36
320	814 54	370	941·81	420	1069·09
325	827·27	375	954·54	425	1081 81
330	839·99	380	967 27	430	1094·54
335	852·72	385	980·00	435	1107 27
340	865 45	390	992 72	440	1120 00
345	878 18	395	1005 45	445	1132·72
350	890·90	400	1018·18	450	1145·45
355	903·63	405	1030·91	455	1158·18



CREEL FOR FLY FRAMES.



SECTION OF FLY FRAMES.



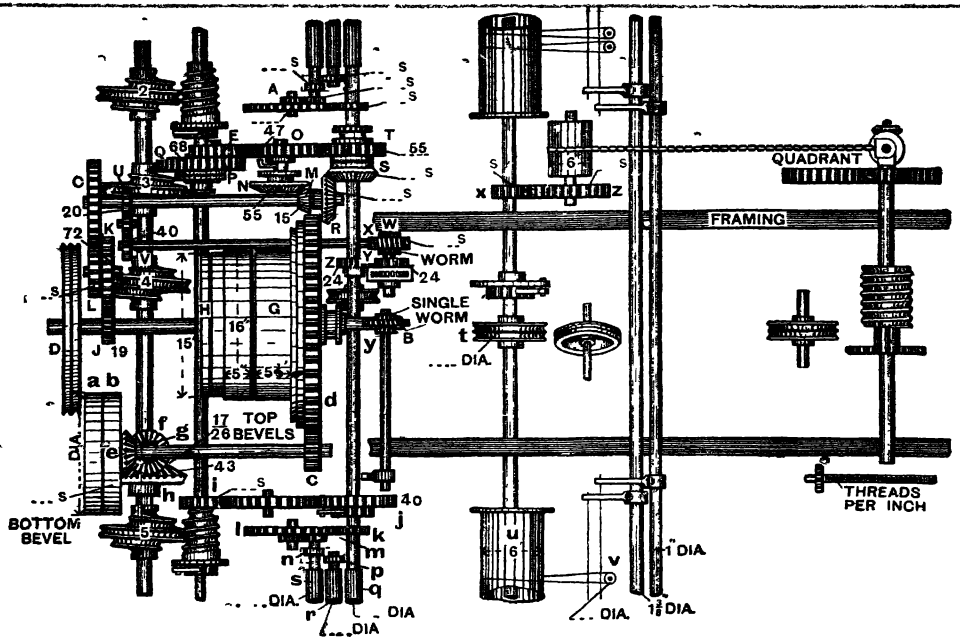
GEARING PLAN OF SELF-ACTING MULE—COARSE AND MEDIUM.

Self-Acting Mules.

REFERENCES TO GEARING PLAN OF S. A. MULE FOR COARSE AND MEDIUM NUMBERS.

A Draft wheel.
B Twist wheel.
C Back change wheel.
D Rim pulley. 2, 3 grooves
E Gain wheel
F Shaper wheel.
G Fast rim shaft pulley.
H Loose rim shaft pulley.
J Rim shaft spur wheel.
K, L } Compound carrier.
M Side shaft bevel. } For Jacking Motion
N Bevel and catch wheel. } For Jacking Motion
O Carrier spur wheel } For Jacking Motion
P Gain pinion.
Q Back shaft spur wheel and catch box.
R Side shaft bevel
S Long boss bevel and catch wheel.
T Roller gear catch box.
U Side shaft spur wheel. } For Roller Motion whilst twisting.
V Change wheel. } For Roller Motion whilst twisting.
W Worm on end of shaft. } For Roller Motion whilst twisting.
X Worm wheel. } For Roller Motion whilst twisting.
Y Spur wheel and catch plate. } For Roller Motion whilst twisting.
Z Coupling-piece wheel. } For Roller Motion whilst twisting.

a Band pulley for drawing-up and backing-off side shaft.
c Backing-off pinion on side shaft.
d Backing-off cone wheel.
e, *f* } Top bevels for upright drawing-up shaft.
g Bottom bevel for upright drawing-up shaft.
h Scroll shaft bevel.
i Spur on back shaft. } Roller Turning Motion whilst winding.
j Click and spur wheel. } Roller Turning Motion whilst winding.
k Front roller wheel - double or single.
l Top carrier wheel.
m Back roller wheel gearing into draft wheel.
n Back roller wheel driving middle roller
p Middle roller wheel
q Front roller.
r Middle roller.
s Back roller.
t Tin roller pulley
u Tin roller.
v Spindles.
x Tin roller wheel
y Twist worm.
z Winding drum wheel.
2&5 Leading to back shaft } Drawing-up Scroll.
3 ,, ,, carriage. } Drawing-up Scroll.
4 Checking carriage. } Drawing-up Scroll.



GEARING PLAN OF SELF-ACTING MULE—FINE.

Self-Acting Mules.

REFERENCES TO GEARING PLAN OF S. A. MULES FOR FINE NUMBERS

A Draft wheel.
B Twist wheel.
C Back change wheel.
D Rim Pulley. 2, 3 grooves.
E Gain wheel.
F Shaper wheel.
G Fast rim shaft pulley.
H Fast and loose pulley for winding motion.
J Rim shaft spur wheel
K, L } Compound carrier
M Side shaft bevel
N Bevel and catch wheel. } For Jacking Motion.
O Carrier spur wheel.
P Gain pinion.
Q Back shaft spur wheel and catch box.
R Side shaft bevel.
S Long boss bevel and catch wheel.
T Roller gear catch box.
U Side shaft spur wheel.
W Worm on end of shaft.
X Worm wheel.
Y Spur wheel and catch plate.
Z Coupling-piece wheel. } For Roller Motion whilst twisting.

a Fast pulley for driving backing-off friction.
b Loose pulley for driving drawing-up shaft.
c Backing-off pinion on side shaft.
d Backing-off cone wheel.
e Bevel for drawing-up.
f Top bevel for upright drawing-up shaft.
g Bottom bevel for upright drawing-up shaft.
h Scroll shaft bevel.
i Spur on back shaft. } Roller Turning Motion whilst winding.
j Click and spur wheel
k Front roller wheel—double or single.
l Top carrier wheel.
m Back roller wheel gearing into draft wheel.
n Back roller wheel driving middle roller.
p Middle roller wheel.
q Front roller.
r Middle roller.
s Back roller.
t Tin roller pulley.
u Tin roller.
v Spindles.
x Tin roller wheel.
y Twist worm.
z Winding drum wheel.
2 & 5 Leading to back shaft } Drawing-up Scroll.
3 ,, ,, carriage
4 Checking carriage.

Self-acting Mules.

Change Places.

A	Draft wheel.	Change wheels, 50 to 70 teeth.
B	Twist ,,	,, ,, 25 ,, 120 ,,
C	Back change wheel.	,, ,, 60 ,, 120 ,,
D	Rim pulley to change speed of spindles, 11 in to 20 in. dia	
E	Gain and stretch	Gain wheel, 69 to 78 teeth.
		Gain ,, pinion, 16 ,, 20 ,,
F	Shaper wheel	12 ,, 80 ,,

Rules for Calculating Change Wheels in Self-acting Mules.

Twist Wheel.

I = No. of inches of yarn put up per draw..
T = Twist per inch ... .
S = Turns of spindle for one of rim ... ...

$$\frac{I \times T}{S} = B = \text{Twist wheel.}$$

Revs. of Front Roller.

D = Dia. of front roller ... ...
G = Gain required ... ...
L = Length of draw . . ..
R = Length of roving turned out by rollers

$$\frac{L-G-R}{D \times 3{\cdot}1416} = Z = \text{Revs of front roller.}$$

Back Change Wheel.

B = Twist wheel ... ...
J = Rim spur .. ..
Z = Revs. of front roller per draw .. ..

$$\frac{B \times J}{Z} = C = \text{Back change wheel.}$$

When double carrier is used, multiply by the smaller and divide by the larger

Draft Wheel.

l = Top carrier wheel ... ...
m = Back roller ,, ...
k = Front roller ,, ...
DR = Draft required ... ...

$$\frac{l \times m}{k \times DR} = A = \text{Draft wheel.}$$

Gain and Stretch.

Z = Revs. of front roller per draw ... ...
55 = Front roller spur for fine numbers ...
51 = ,, ,, ,, coarse ,, ...
68 = Back shaft wheel .. ..
3·62 = Revs of back shaft per draw of 66 ins.
3·5 = ,, ,, ,, ,, 64 ,,
3·4 = ,, ,, ,, ,, 62 ,,
3·29 = ,, ,, ,, ,, 60 ,,
3·18 = ,, ,, ,, ,, 58 ,,
3·07 = ,, ,, ,, ,, 56 ,,
2·96 = ,, ,, ,, ,, 54 ,,
2·8 = ,, ,, ,, ,, 52 ,,
2·7 = ,, ,, ,, ,, 50 ,,
P = Gain wheel pinion ... ...
E = Gain wheel ... ...

$$\frac{68 \times E \times \begin{cases} 3{\cdot}62 \\ 3{\cdot}5 \\ 3{\cdot}4 \\ 3{\cdot}29 \\ 3{\cdot}18 \\ 3{\cdot}07 \\ 2{\cdot}96 \\ 2{\cdot}8 \\ \text{or} \\ 2{\cdot}7 \end{cases}}{Z \times 51 \text{ or } 55} = P = \text{Gain wheel pinion.}$$

$$\frac{Z \times 51 \text{ or } 55 \times P}{68 \times \begin{cases} 3{\cdot}62 \\ 3{\cdot}5 \\ 3{\cdot}4 \\ 3{\cdot}29 \\ 3{\cdot}18 \\ 3{\cdot}07 \\ 2{\cdot}96 \\ 2{\cdot}8 \\ \text{or} \\ 2{\cdot}7 \end{cases}} = E = \text{Gain wheel.}$$

Self-Acting Mules.

Notes.

Aprox. Power.—Mules for Indian, American and low classes of cotton, 120 spindles to 1 m.h.p. Mules for Egyptian and better classes of cotton, 130 to 140 spindles to 1 m.h.p.

Driving Pulley.—16 in. dia. for 4 in., 4½ in., 5 in., or 5½ in. straps "Duplex" for 2½ in or 3 in strap.

Space Occupied.—Multiply the number of spindles in the mule by the space of spindles, and add 6 ft. 0 in., or 1,83 m, the rollers being geared at headstock See page 137 for space occupied by a pair of mules.

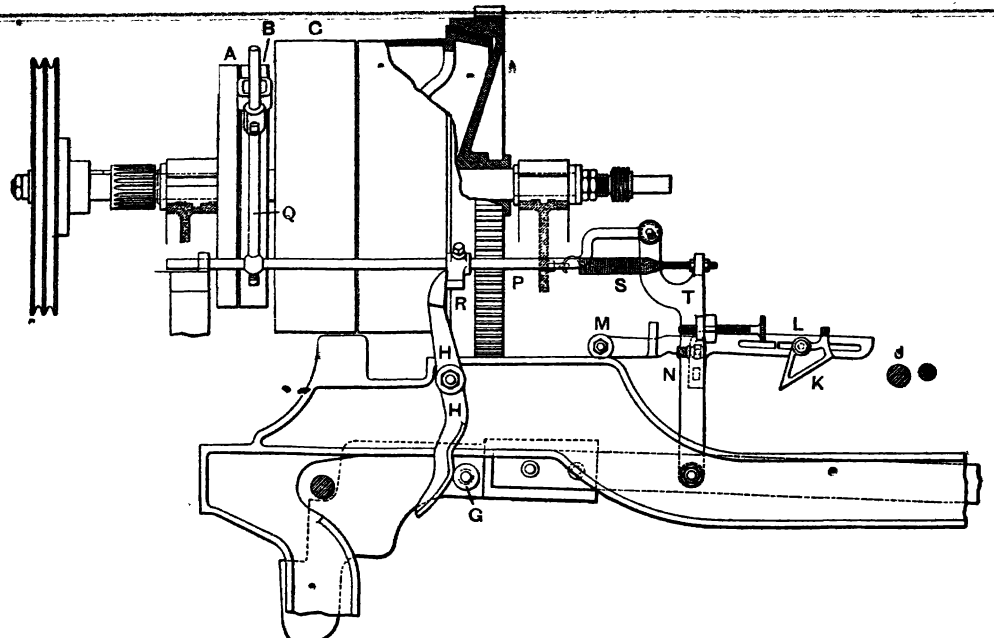
Strapping required.— (For Double-speed Driving):— Line shaft to counter shaft, 100 ft. × 5 in. Counter shaft to headstock "Duplex" Driving, 48 ft. × 2½ in. or 3 in.

(For Single-speed Driving:—Line shaft to counter shaft, 50 ft. × 6 in. Counter shaft to headstock, single speed driving, 24 ft × 4 in, 4½ in., 5 in., or 5½ in Winding motion strap, 24 ft. × 1½ in. Drawing-up strap 26 ft × 2½ in.

Banding.—It is important that in order to ensure the good working of the mules, the following diameters of bands must be used:—For double-grooved rim. $\frac{9}{16}$ in., or for treble grooved rim, $\frac{7}{16}$ in.; back shaft drawing-out scrolls, and counter shaft to drawing-up and backing-off shaft, $\frac{9}{16}$ in.; for drawing-up scrolls, drawing-up coarse scroll on back shaft, quadrant, and for check scrolls, $\frac{7}{8}$ in.; for governor motion and squaring band pulleys underneath carrier, $\frac{3}{8}$ in.

Banding required (for Strap drawing up). 70 ft. of $\frac{7}{8}$ in., 248 ft. of $\frac{9}{16}$ in., and 117 ft. of $\frac{3}{8}$ in. Spindle banding, 393 spindles to 1 lb. of banding. Length of band, 3 ft. 5 in. when pieced.

Banding required (for Band Drawing-up): 70 ft of $\frac{7}{8}$ in., 286 ft. of $\frac{9}{16}$ in., and 117 ft of $\frac{3}{8}$ in. Spindle banding, 393 spindles to 1 lb. of banding. Length of band, 3 ft. 5 in. when pieced.



IMPROVED WINDING MOTION.

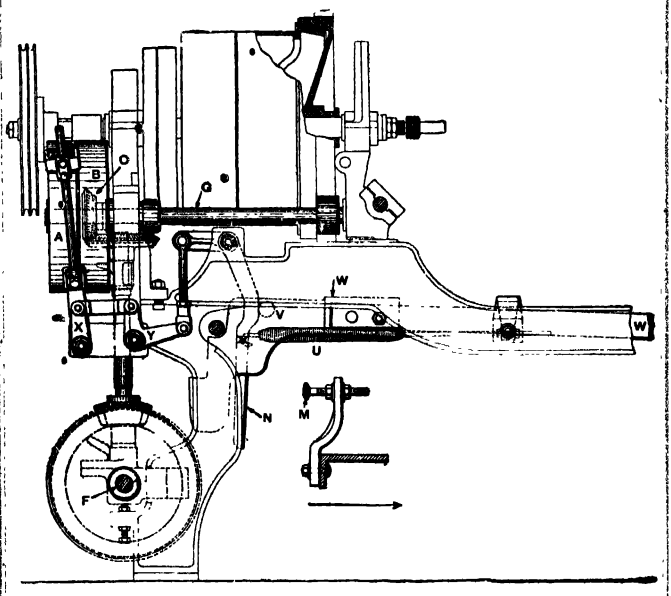
IMPROVED WINDING MOTION.

A	Fast pulley.	M	Centre for latch lever.
B	Loose pulley.	N	Projection on upright lever.
C	Loose rim shaft pulley.	P	Strap fork link.
G	Bowl on long lever.	Q	Strap fork.
H	Double lever.	R	Strap fork link finger.
J	Faller shaft.	S	Spring.
K	Incline tumble.	T	Upright lever.
L	Latch lever.		

This motion possesses many advantages over the older form. Its object is to give, when spinning fine counts, an increased motion to the spindles previous to the carriage getting in, in order to wind on the slack yarn that results through the copping faller lifting. Snarls and cut yarns are consequently avoided It is arranged so that it can be put into action up to within eight inches of the completion of the inward run.

Its action is as follows.—As represented in the illustration, drawing-up is taking place. The carriage is running in. Driving strap is on the loose pulley C. Winding strap is on the loose pulley B. As the carriage runs in, the faller shaft J comes in contact with and raises the incline tumbler K and likewise the lever L which is centred at M. The rising of lever L releases the projection N on the lever T; this allows the tension spring S to pull back the lever T, rod P which is attached to lever. finger R and strap fork Q, which are attached to the rod. The strap fork Q moves the strap on to the fast pulley A, and at the same time the finger R moves back the top portion of the double lever H. The lower end of the double lever H is suitably shaped so as to be actuated by the bowl G on long lever.

At the completion of the inward run, the long lever when changing the carriage gear motion in the usual manner, rises, and the bowl G forces back the bottom portion of the double lever H. This moves forward the rod P by means of finger R to its original position, allowing the lever L to latch upon the projection N, at the same time putting tension in the spring S in readiness for the next draw, and the winding strap is put upon the loose pulley B.

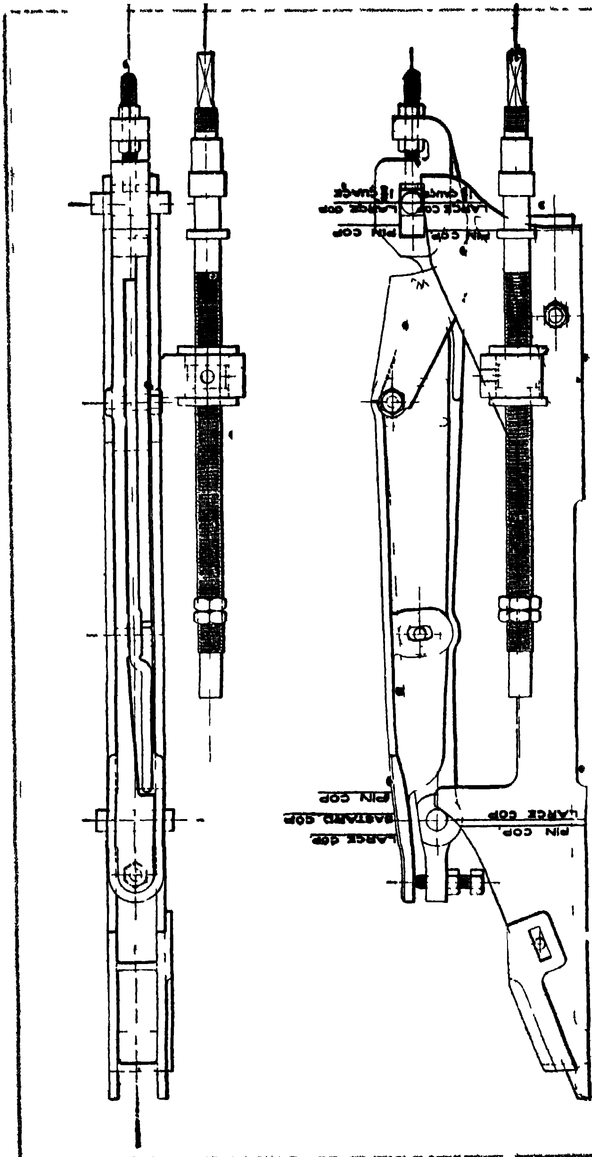


DRAWING-UP MOTION BY STRAP.

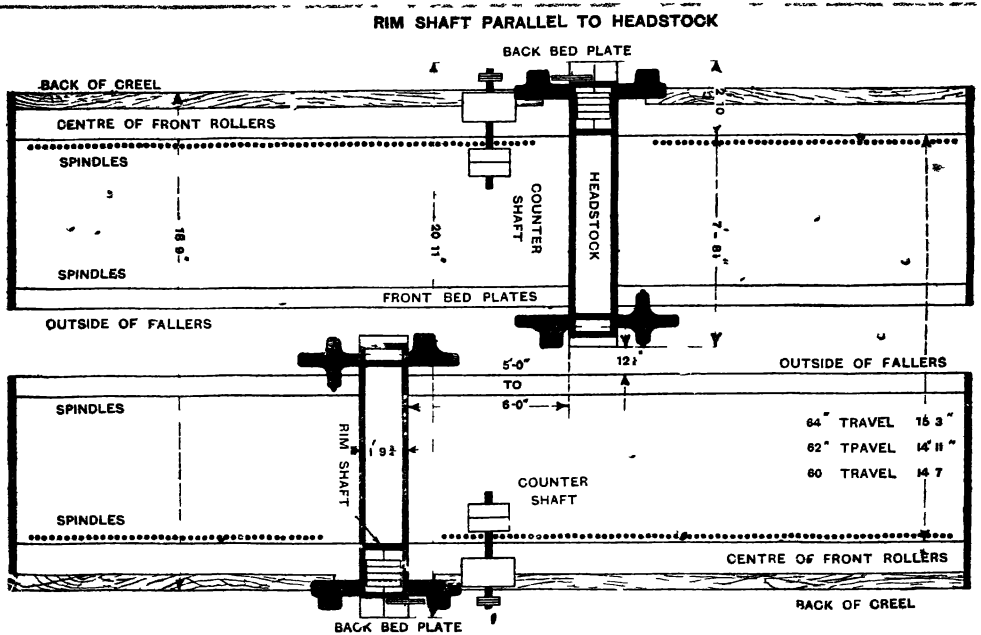
DRAWING UP AND BACKING OFF MOTION BY STRAP

A Fast pulley for driving backing off
B Loose pulley for drawing up
C Bevel for drawing up
F Scroll shaft
G Backing off shaft
M Adjusting screw on square for changing drawing up
N Drawing up lever
U Spring
V Bowl
W Long lever
X, Y Combined levers

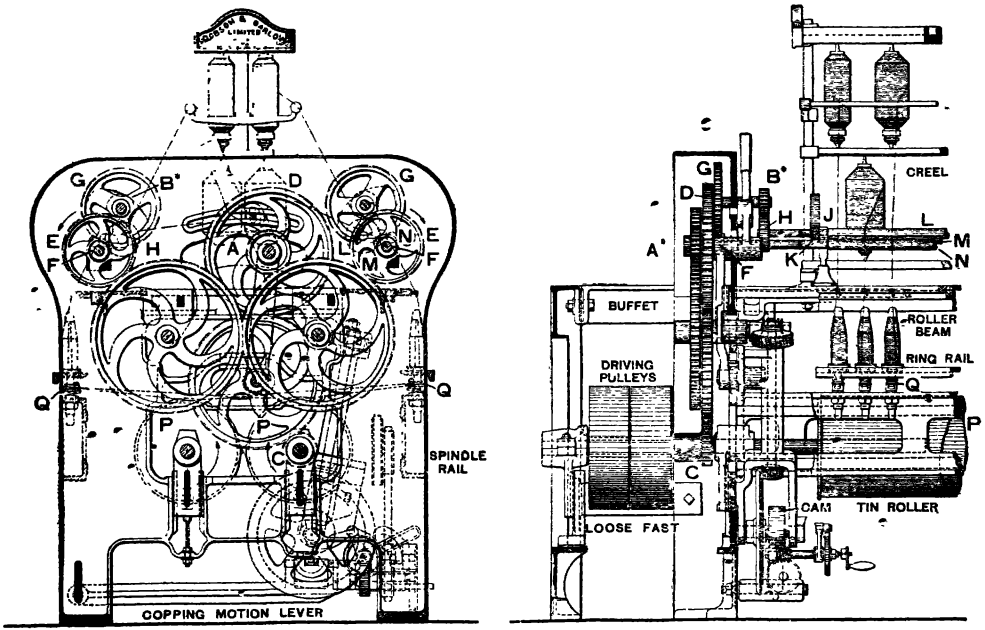
The illustration on the opposite page shows a greatly improved form of a combined drawing up and backing off motion by means of a strap and is specially arranged for spinning counts from 80's upwards Its action is of a very simple character, and easily understood from the drawing When the motion is in the position shown, the strap will be on the backing off pulley A which is keyed to the shaft G The carriage moves outwards, and at the completion of its travel the long lever W, to which is attached the bowl V, changes, allowing the bowl to descend to a position opposite the recess in the lever N, by this action the lever N is released and pulled by means of the spring U having previously been put in tension This has the effect of changing the strap from the backing off pulley A on to the drawing up pulley B, and through its connection with the bevel C draws up the carriage by means of the scrolls on F As the carriage moves in, an adjusting screw M fixed on the carriage square comes in contact with the lever N, the result being that the strap is again moved on to the backing off pulley A This movement gives clearance for the long lever to change back to its original position and to take back with it the bowl V, which holds the lever N in position and therefore detains the strap on the backing off pulley A until the long lever W again changes and drawing up begins The combined levers X and Y are constructed to give a quick action to the movement of the strap fork



SHORT SHAPER.



PLAN OF A PAIR OF MULES, SHOWING DIMENSIONS.



GEARING PLAN OF RING SPINNING FRAME.

RING SPINNING FRAMES.

REFERENCES TO GEARING OF RING SPINNING FRAME.

A	Twist wheel. Change place, 20 to 70 teeth.	H	Back roller wheel.
B	Draft wheel. Change place, 26 to 60 teeth	J	Back roller wheel driving middle roller.
C	Tin roller wheel.	K	Middle roller wheel.
D	Twist carrier wheel.	L	Back roller.
E	Front roller wheel.	M	Middle roller.
F	20's Front roller wheel	N	Front roller.
G	Crown wheel.	P	Tin roller
		Q	Spindle warve.

CALCULATIONS

$$\text{Speed of Spindles} = \frac{\text{Revs of P} \times \text{P}}{\text{Q}}$$

$$\text{Revolutions of Front Roller} = \frac{\text{Revs of C} \times \text{C} \times \text{A}}{\text{D} \times \text{E}}$$

$$\text{Turns of Spindle for one of Front Roller} = \frac{\text{E} \times \text{D} \times \text{P}}{\text{A} \times \text{C} \times \text{Q}}$$

$$\text{Twist per inch} = \frac{\text{E} \times \text{D} \times \text{P}}{\text{A} \times \text{C} \times \text{Q} \times \text{N} \times 3{\cdot}1416}$$

$$\text{Twist Wheel} = \frac{\text{E} \times \text{D} \times \text{P}}{\text{Twist per inch} \times \text{C} \times \text{Q} \times \text{N} \times 3{\cdot}1416}$$

$$\text{Constant Number for Twist} = \frac{\text{E} \times \text{D} \times \text{P}}{\text{C} \times \text{Q} \times \text{N} \times 3{\cdot}1416}$$

$$\text{Twist Wheel} = \frac{\text{Constant Number}}{\text{Twist per inch}}$$

$$\text{Twist per inch} = \frac{\text{Constant Number}}{\text{Twist Wheel}}$$

$$\text{Draft} = \frac{\text{H} \times \text{G} \times \text{N}}{\text{B} \times \text{F} \times \text{L}} \qquad \text{Draft Wheel} = \frac{\text{H} \times \text{G} \times \text{N}}{\text{Draft} \times \text{F} \times \text{L}}$$

$$\text{Constant Number for Draft} = \frac{\text{H} \times \text{G} \times \text{N}}{\text{F} \times \text{L}}$$

$$\text{Draft} = \frac{\text{Constant Number}}{\text{Draft Wheel}} \qquad \text{Draft Wheel} = \frac{\text{Constant Number}}{\text{Draft}}$$

$$\text{Star Wheel} = \text{Present Wheel} \times \frac{\sqrt{\text{Counts required}}}{\sqrt{\text{Present Counts}}}$$

NOTES.

Approximate Power.—Spindle speed 7,000 to 8,500 revs per min., 100 spindles per 1 m.h.p ; 9,000 revs. per min., 90 spindles per 1 m.h.p.

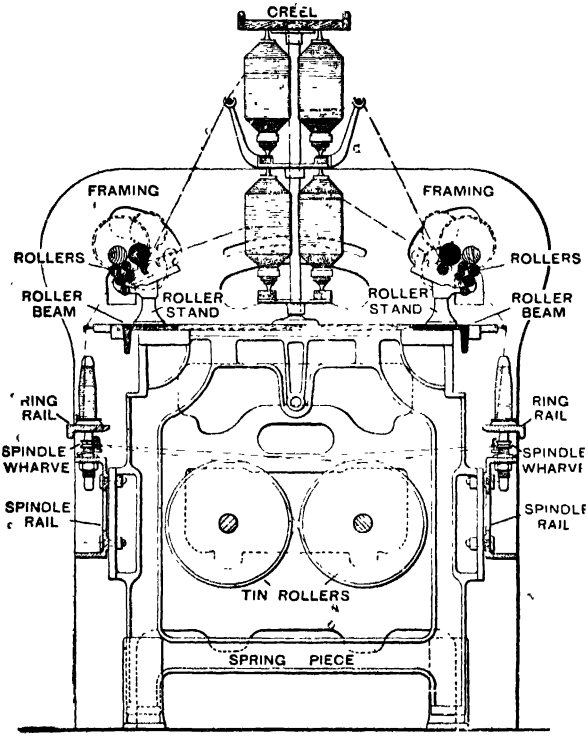
Driving Pulley.—12 in. dia. Width, 4 in , 4½ in , or 5 in , according to length of frame.

Banding, 11 ft of ¼ in. when rope driving at out-end.

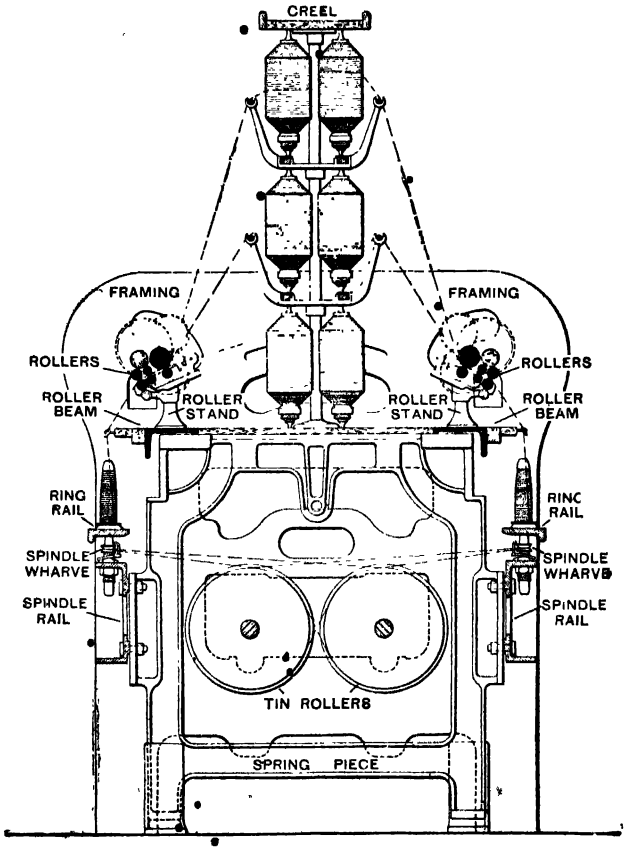
Spindle banding, 87 spindles to 1 lb. of banding. Length of band, 5 ft. 6 in. when pieced.

Space Occupied.—Multiply half the number of spindles in the frame by the space of the spindles and add for gearing, etc., as follows :—Gallows pulley driving : 2 ft. 8 in., or 0,813m. (9½ in. buffets), for single-driven frames ; and 5 ft. 3¾ in., or 1,619m. (9½ in buffets), for frames driven at each end. Direct driving by half-twisted strap : 3 ft. 1 in., or 0,939 m (14½ in. buffets), for single-driven frames. This length depends upon the height of line-shaft and dia. of pulley on line-shaft, if a low shaft and large pulley 3 ft. 1 in. is exceeded.

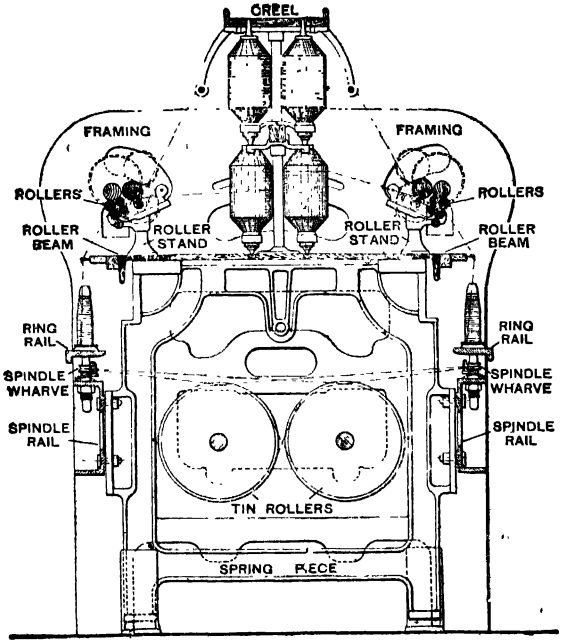
For single-driven in some part, 3 ft 9½ in. for 4 in. wide pulleys (9½ in. buffets) ; 3 ft. 11½ in. for 5 in. wide pulleys (11½ in. buffets). Gallows pulley driving No. 3 (see sketch below) is invariably used for driving ring frames. Width of frame, 3 ft. or 0,914 m.



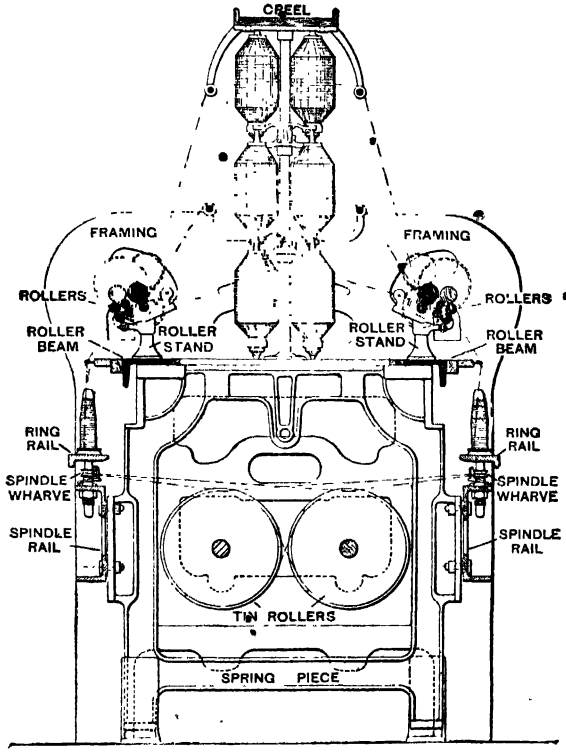
RING SPINNING FRAME, SHEWING ORDINARY CREEL FOR SINGLE ROVING.



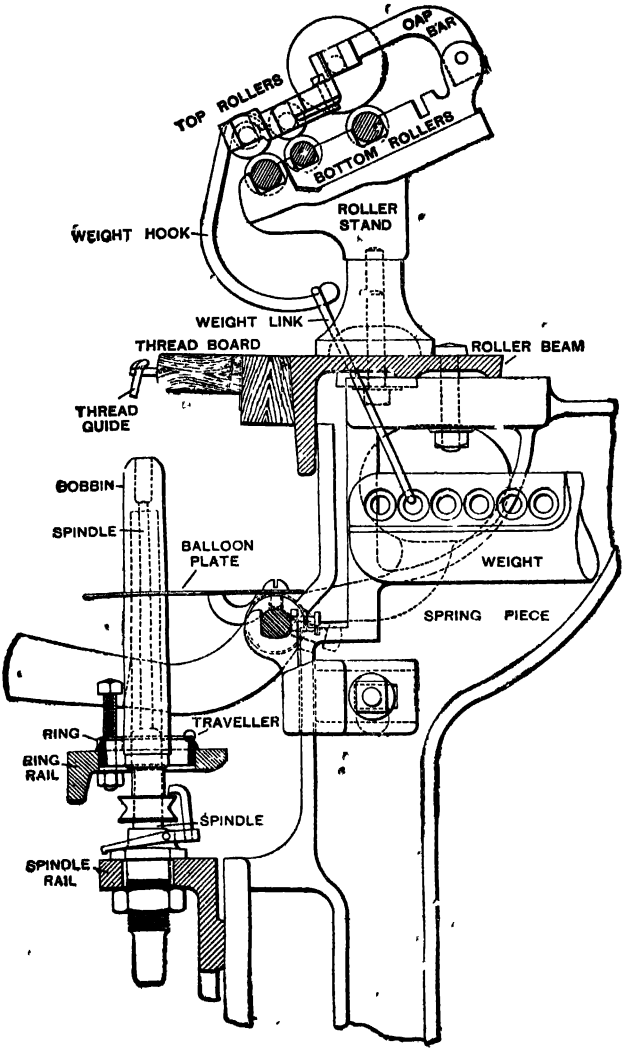
RING SPINNING FRAME, SHEWING ORDINARY CREEL FOR DOUBLE ROVING.



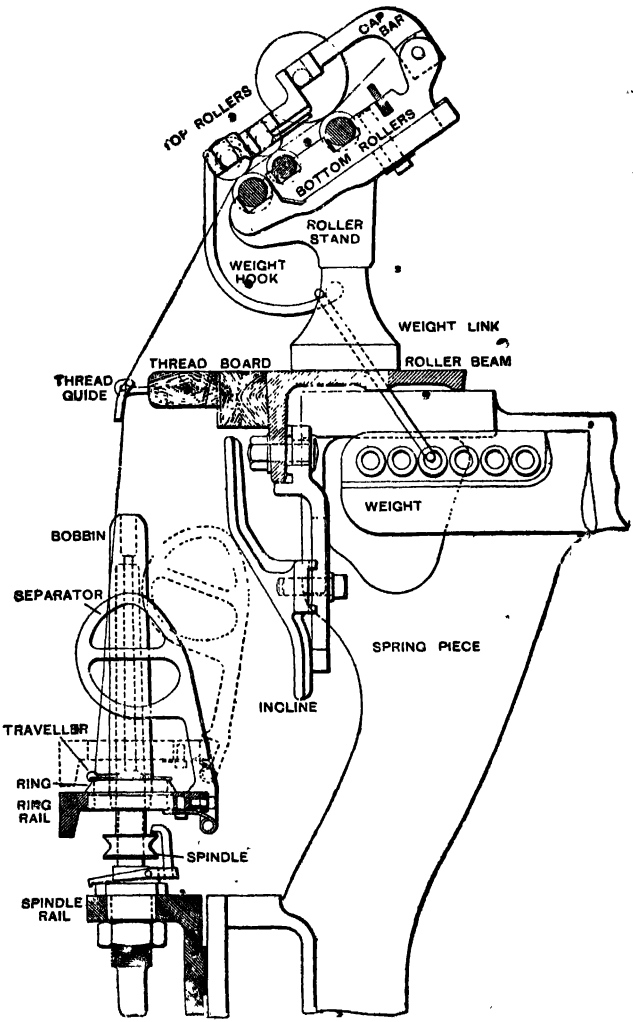
RING SPINNING FRAME, SHEWING BIRKENHEAD CREEL FOR SINGLE ROVING.



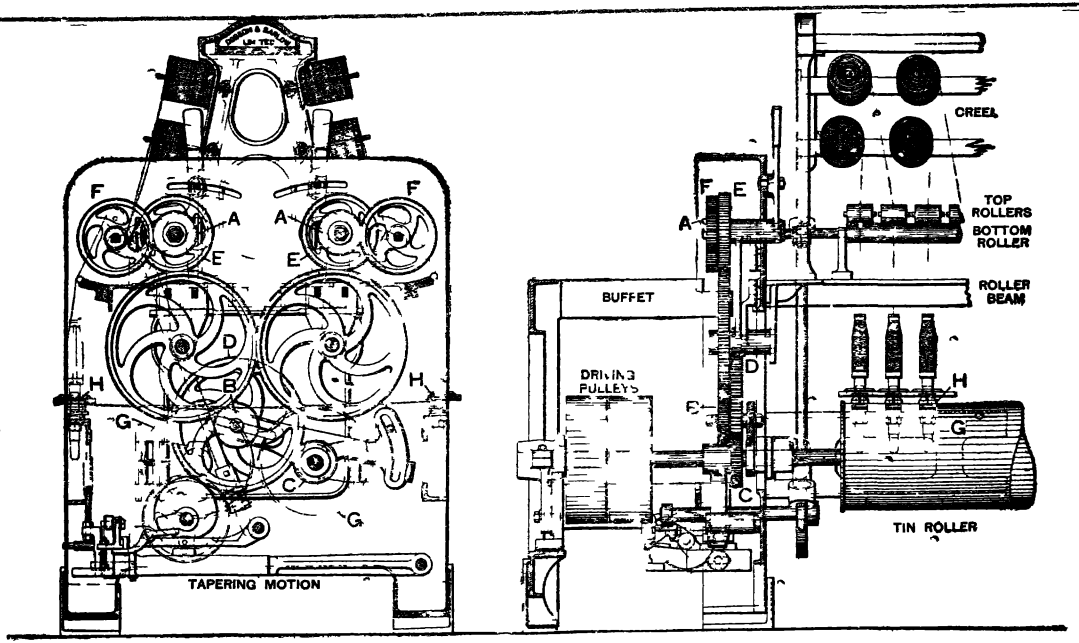
RING SPINNING FRAME, SHEWING BIRKENHEAD CREEL FOR DOUBLE ROVING.



PART SECTION OF RING SPINNING FRAME SHEWING BALLOON PLATE



PART SECTION OF RING SPINNING FRAME SHEWING SEPARATOR IN AND OUT OF ACTION.



GEARING PLAN OF RING DOUBLING FRAME.

RING DOUBLING FRAME.

REFERENCES TO GEARING OF RING DOUBLING FRAME.

A Top twist wheel. Change place, 20 to 80 teeth.

B Bottom twist wheel. Change place, 20 to 60 teeth.

C Tin roller wheel

D Bottom twist carrier wheel.

E Top twist carrier wheel.

F Front roller wheel

G Tin roller.

H Spindle warve.

J Bottom roller

CALCULATIONS.

Speed of Spindles $= \frac{\text{Revs of G} \times \text{dia of G}}{\text{Dia of H}}$

Revs. of Front Roller $= \frac{\text{Revs of C} \times \text{C} \times \text{B} \times \text{A}}{\text{D} \times \text{E} \times \text{F}}$

Turns of Spindle for one of Front Roller $= \frac{\text{F} \times \text{E} \times \text{D} \times \text{G}}{\text{A} \times \text{B} \times \text{C} \times \text{H}}$

Twist per inch $= \frac{\text{F} \times \text{E} \times \text{D} \times \text{G}}{\text{A} \times \text{B} \times \text{C} \times \text{H} \times \text{J} \times 3{\cdot}1416}$

Twist Wheel A $= \frac{\text{F} \times \text{E} \times \text{D} \times \text{G}}{\text{Twist} \times \text{B} \times \text{C} \times \text{H} \times \text{J} \times 3{\cdot}1416}$

Twist Wheel B $= \frac{\text{F} \times \text{E} \times \text{D} \times \text{G}}{\text{A} \times \text{Twist} \times \text{C} \times \text{H} \times \text{J} \times 3{\cdot}1416}$

Ring Doubling Frames.

Space occupied (English system).—Multiply half the number of spindles in the frame by the space of the spindles, and add for gearing, etc., as follows:—Gallows pulley driving, 2 ft. 9 in. or 0,838 m., for single-driven frames; double-driven frames, 4 in strap, 4 ft 5 in., or 1,346 m. Direct driving by half-twisted strap, 3 ft. 1 in., or 0,94 m., this length depends upon height of line shaft, if a low shaft and large pulley 3 ft. 1 in. is exceeded Single driven in middle gallows pulley driving, 3 ft. 6 in., or 1,067 m., for 4 in. strap; 3 ft. 8 in., or 1.118 m., for 5 in. strap. Gallows pulley driving is invariably used for double and single-driven in middle

Space occupied (Scotch system).— Gallows pulley driving, 2 ft. 10¾ in., or 0,883 m. for single-driven frames. Direct driving by half-twisted strap, 3 ft. 2¾ in., or 0,984 m.

Width of Framing (English system).—

3 ft. 0 in. or 0,914 m. for 10 in. double tin rollers.
3 ft. 0 in. ,, 0,914 m ,, 8 in. and 9 in. single tin rollers
3 ft. 6 in. ,, 1,067 m. ,, 9 in. and 10 in ,, ,, ,,

Width of Framing (Scotch system).—

3 ft. 0 in. or 0,914 m. for 10 in. double tin rollers.
2 ft. 10 in. or 0,864 m. for single tin rollers.

Ring Doubling Frames.

NOTES.

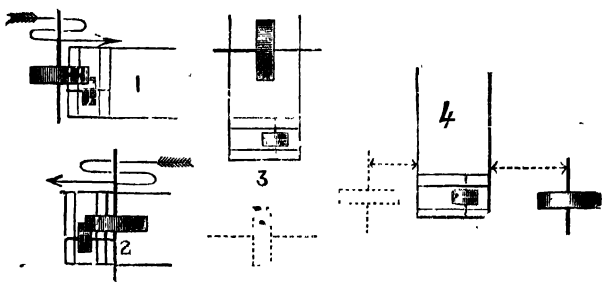
Approximate Power.—Dry doubling, 55 spindles 1 m.h.p.; wet doubling. 50 spindles 1 m.h.p.; 2 in. ring. A larger ring, there will be less spindles per h.p.; a smaller ring, more spindles per h.p.

Driving Pulley.—12 in. dia.; width, $3\frac{1}{2}$ in., 4 in., or $4\frac{1}{2}$ in., according to length of frame.

Strapping required.—Line shaft to machine, gallows pulley driving, 60 ft. × 3 in., $3\frac{1}{2}$ in., or 4 in., direct driving by open strap, 30 ft × 3 in., $3\frac{1}{2}$ in., or 4 in.

Banding, 11 ft. of $\frac{1}{2}$ in. when rope driving at out-end

Spindle banding, 72 spindles to 1 lb. of banding. Length of band, 5 ft. 7 in. when pieced

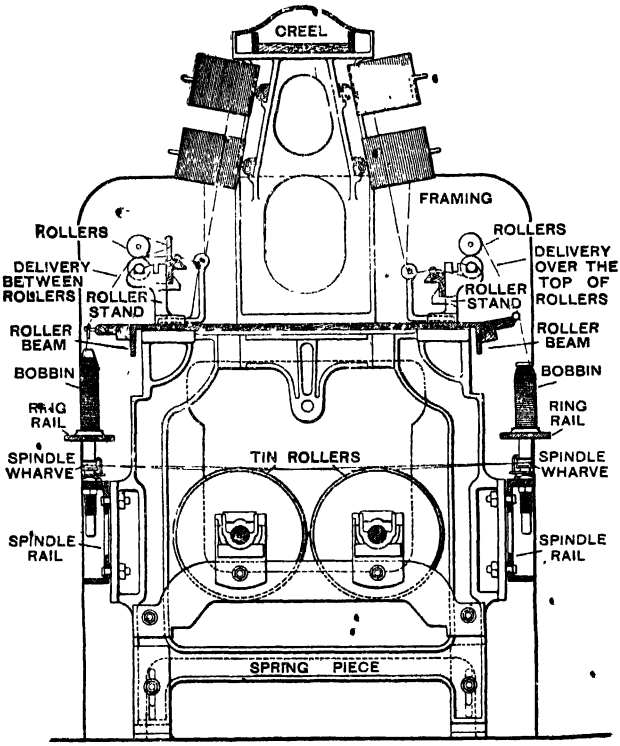


1 and 2.—Direct driving by half-twisted strap.

3.—Gallows pulley driving.

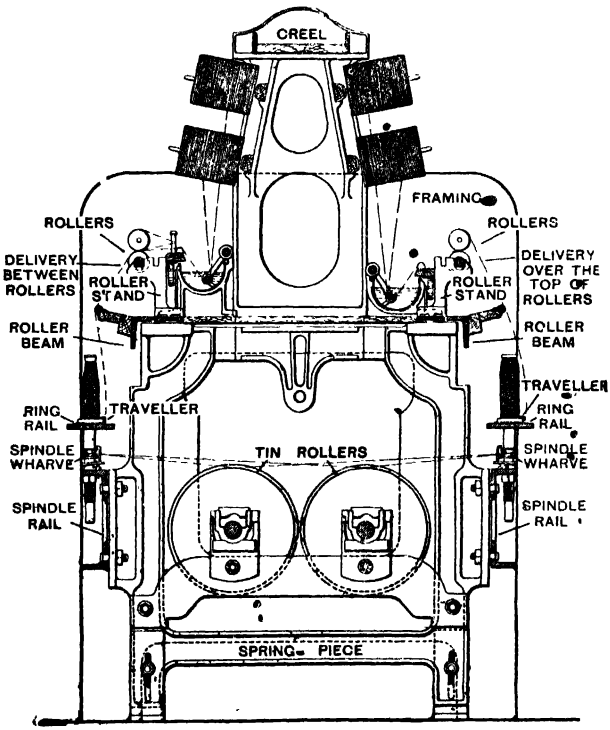
4.—Direct driving by open strap

To determine the hand of the frame, face the gearing end, looking lengthwise of frame, and note if the pulleys are to be placed on right or left hand side.

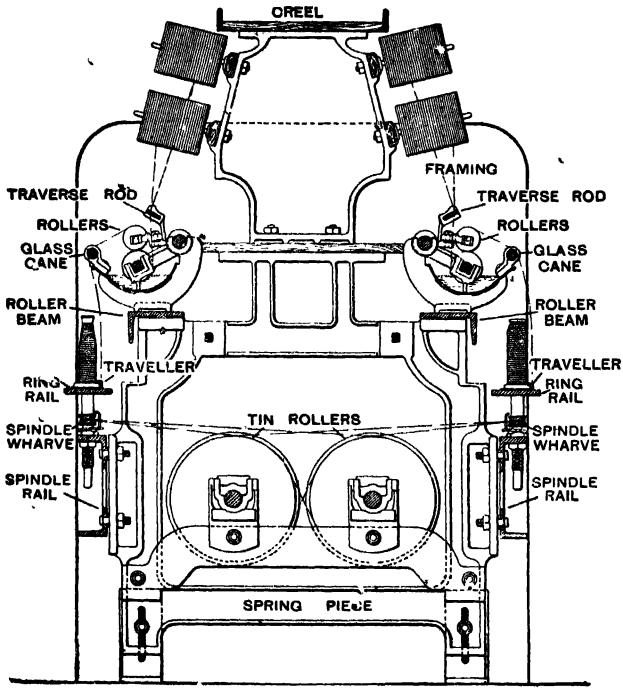


SECTION OF RING DOUBLING FRAME,

DRY DOUBLING.

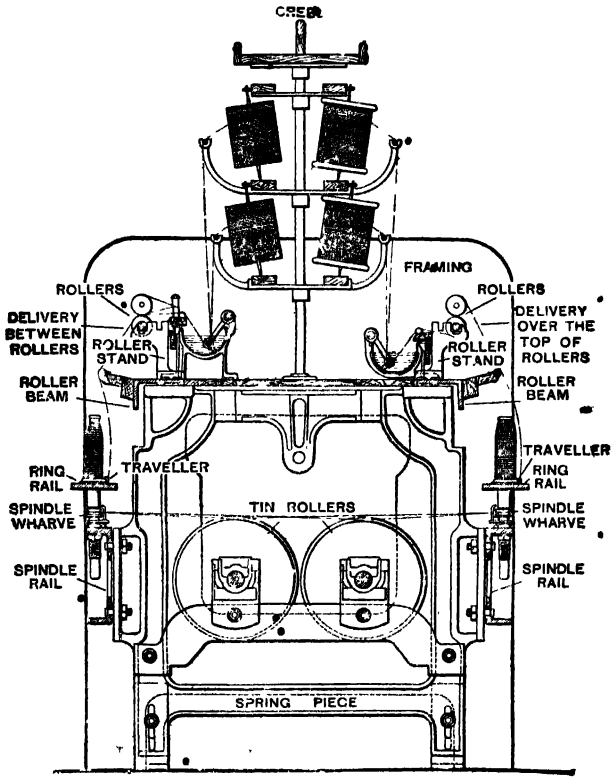


SECTION OF RING DOUBLING FRAME,
WET DOUBLING, ENGLISH SYSTEM.

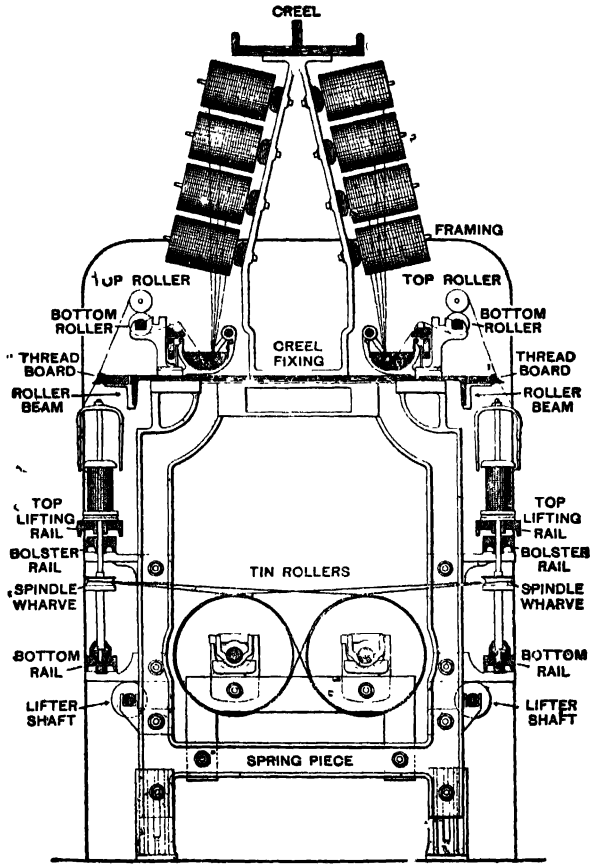


SECTION OF RING DOUBLING FRAME,

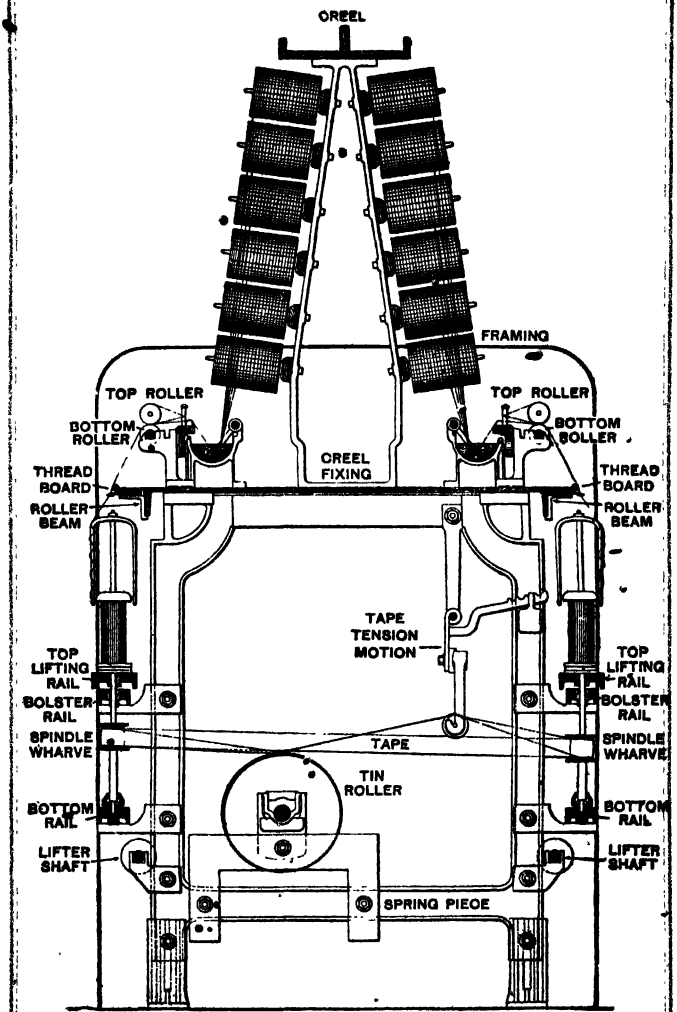
WET DOUBLING, SCOTCH SYSTEM.



SECTION OF FINE DOUBLER.



SECTION OF FLYER DOUBLER SHEWING 4-HEIGHT CREEL AND BAND DRIVE FOR SPINDLES.



SECTION OF FLYER DOUBLER SHEWING 6-HEIGHT CREEL AND TAPE DRIVE FOR SPINDLES.

QUICK TRAVERSE WINDING FRAME

PATENT QUICK TRAVERSE DRUM WINDING FRAME.

NOTES.

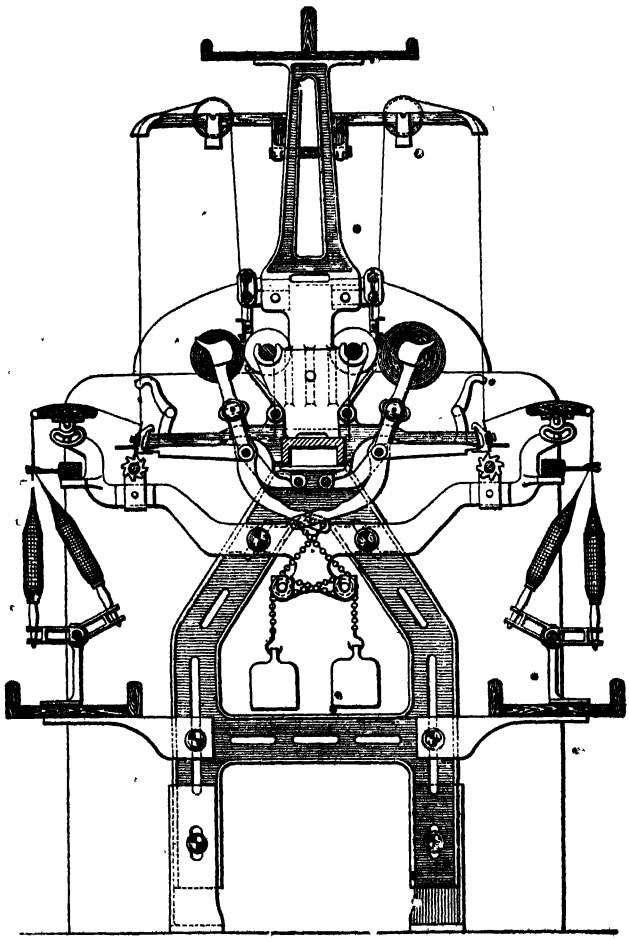
Approximate Power —100 drums to 1 m.h.p.

Pulleys and Speeds —10 in dia × 3 in. wide, speed 150 revs. per min, according to class of material, gives from 100 to 160 yds. per min.

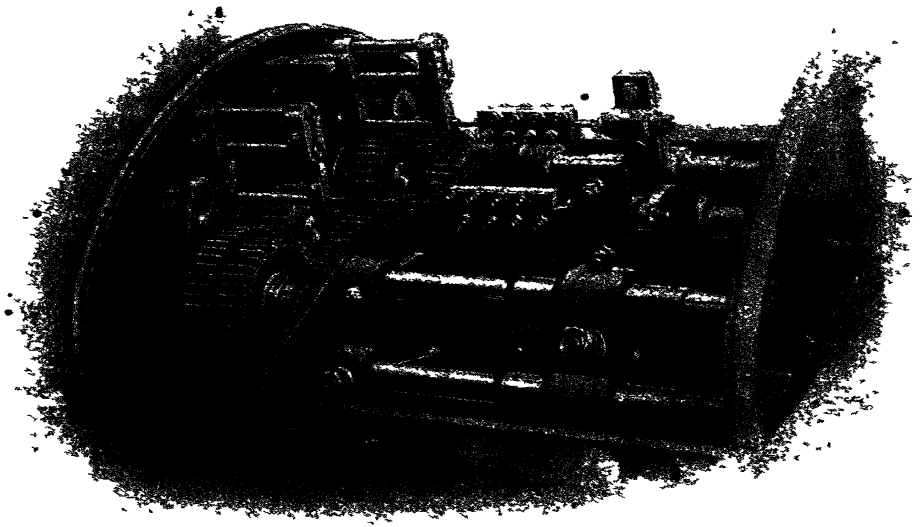
Space Occupied.—Multiply half the number of drums in the machine by 6½ in. for 4½ in. traverse, 7 in. for 5 in. traverse, and 8 in for 6 in traverse, and add for gearing, etc, 3 ft. 10½ in., or 1·18 m. Width of frame, 3 ft. 3 in., or 0 990 m.

Strapping Required.—Line shaft to machine, 30 ft. × 3 in.

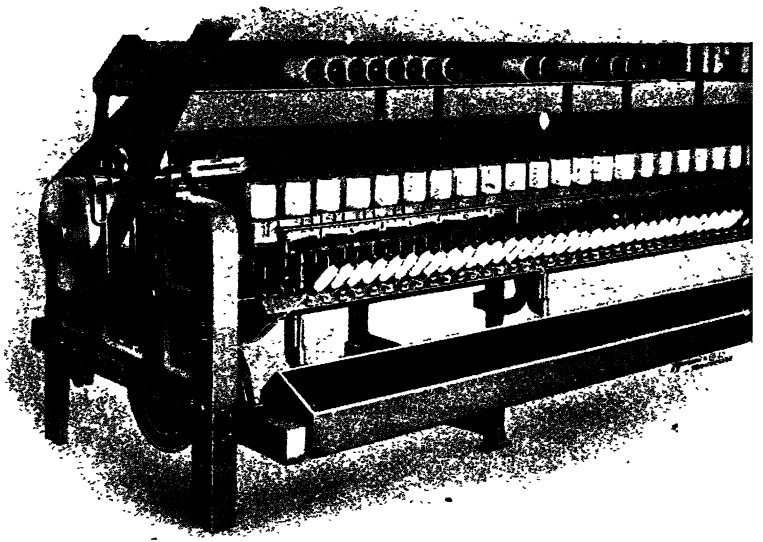
We have patterns for making frames 4½ in., 5 in., and 6 in. traverse, and have patterns of cams for 3 in., 4½ in., 5 in., and 6 in traverse



SECTION OF QUICK TRAVERSE WINDING FRAME.



VIEW OF GEARING SHEWING TRAVERSE RODS, SLIDES, AND CAM.



IMPROVED UPRIGHT SPINDLE WINDING FRAME.

IMPROVED UPRIGHT SPINDLE WINDING FRAMES.

Notes.

Approximate Power.—300 spindles to 1 m.h.p.

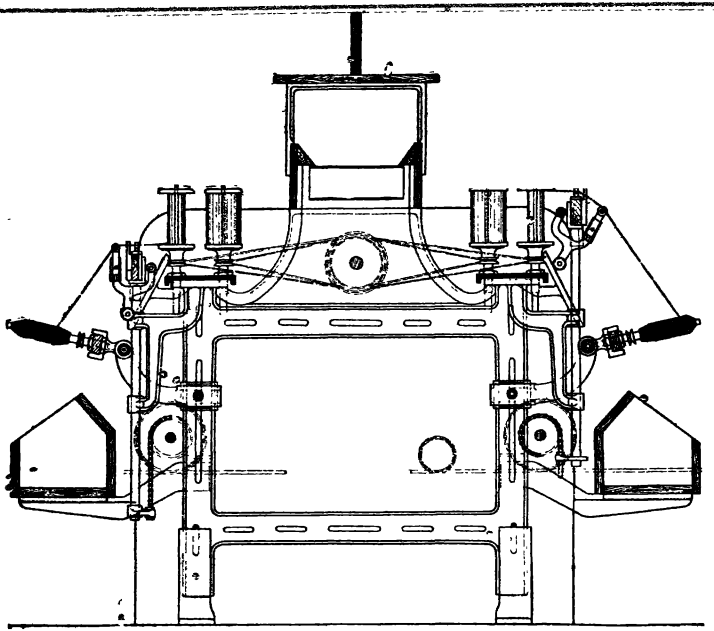
Pulleys and Speed.—10 in. dia., 160 revs. per min.

Space Occupied.—Multiply quarter the number of spindles in the frame by the space of the spindles, and add for gearing 2 ft. Also if travelling apron is applied, add 8 in. Width of frame, 5 ft 3 in.

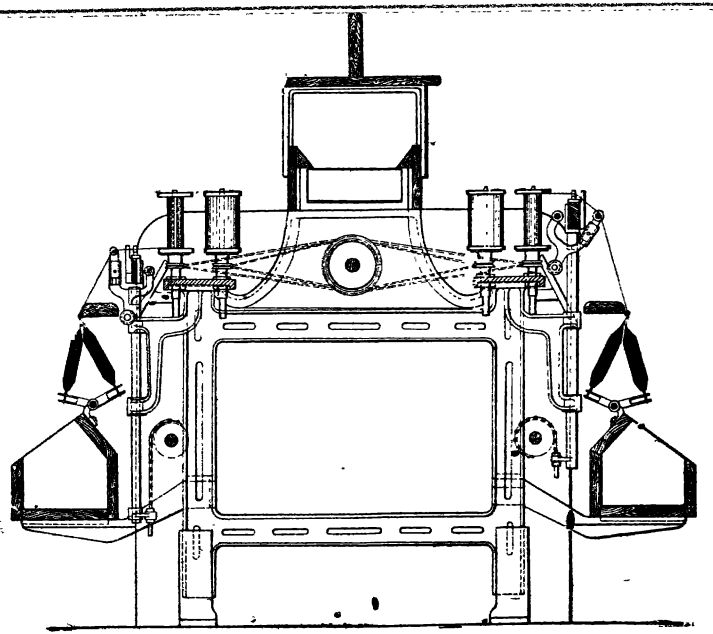
Production.—The production depends on how many spindles an operative can mind, the class of yarn being wound, and the speed it will stand without breakage. For single 30's yarn, about 16 lb. per spindle, per 56½ hours.

Approximate Weights and Measurements.

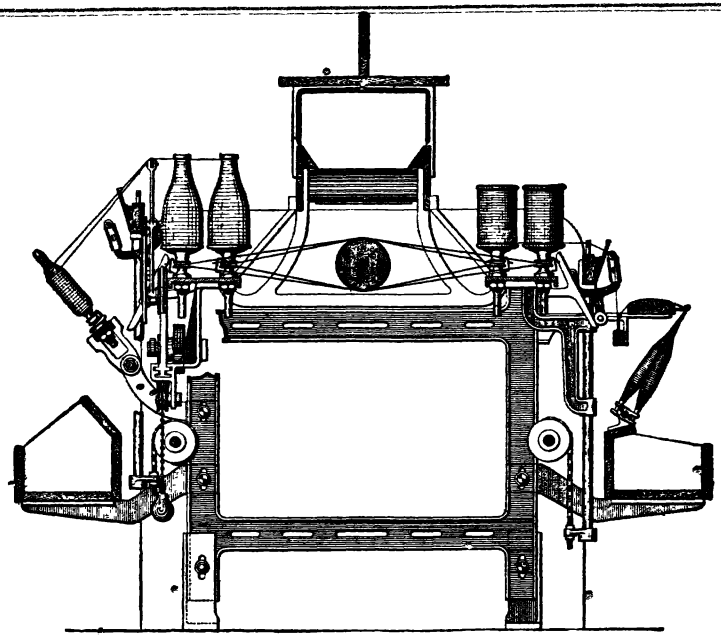
No. of Spindles.	Gauge.	Gross.	Net.	Cubic measurement.
	Inches.	Cwts.	Cwts.	Feet.
260	5	37	27	191
320	5	64	49	263



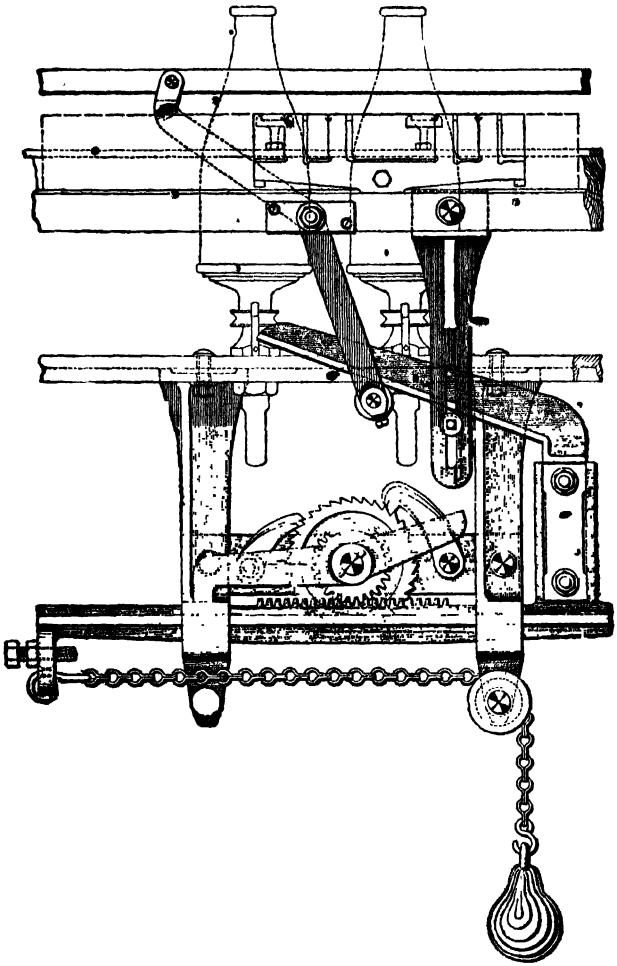
SECTION OF UPRIGHT SPINDLE WINDING FRAME, TO WIND FROM RING BOBBINS.



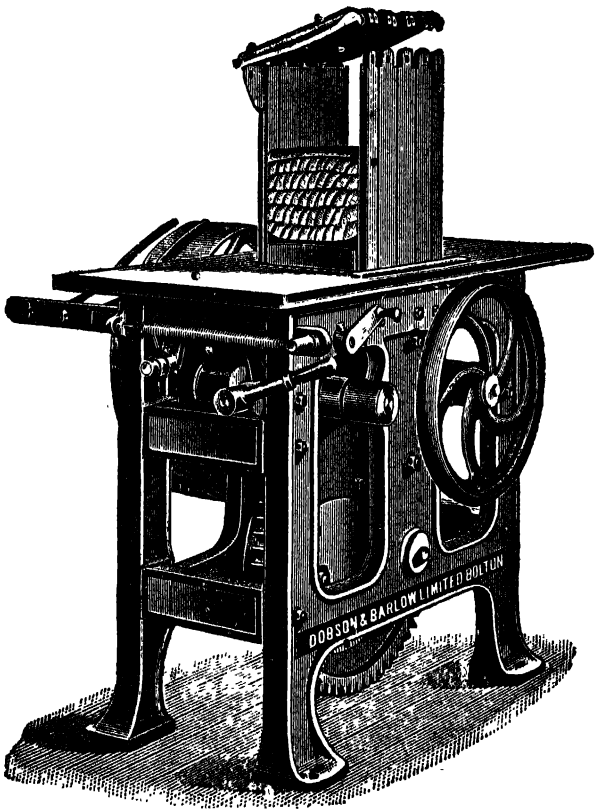
SECTION OF UPRIGHT SPINDLE WINDING FRAME, TO WIND FROM COPS.



SECTION OF UPRIGHT SPINDLE WINDING FRAME, WINDING BOTTLE-SHAPED AND WARPERS' BOBBINS.



BOTTLE-SHAPED BOBBIN BUILDING MOTION FOR UPRIGHT SPINDLE WINDING FRAME.



PATENT YARN BUNDLING PRESS.

PATENT YARN BUNDLING PRESS

WITH AUTOMATIC ARRANGEMENT FOR OPENING AND CLOSING THE BARS.

SPECIALITIES AND IMPROVEMENTS.

This press is made from most approved patterns, arranged to be driven both by hand and power, and will make bundles 10 lbs. each.

Strong planed cast-iron framing; yarn box 12 in. long by 8½ in. wide, with 4 strings; improved double eccentric lifting motion for lifting press table, with extra strong gearing, and polished wood table.

Extra block and linings, to make bundles 5 lbs. each, are supplied, when required, to fit the press.

NOTES

Power.—1 m h.p. per press.

Production.—1,800 lbs. per day of 10 hours.

Driving Pulley.—16 in. dia. × 3 in. wide, 60 revs. per minute.

Space Occupied.—4 ft. 0 in. × 2 ft. 6 in., or 1,219 m. × 0,762 m.

Approximate Weights.—Gross, 13 cwts; net, 10 cwts.

Cubic Measurement.—59 ft.

Strapping Required.—Line shaft to machine, 22 ft. × 3 in.

COTTON.

The chief contributors to the European supply are, in the order of their importance, as follows:—The United States, India, Egypt, Brazil, and Peru Besides the cotton indigenous to most of these countries, nearly all produce different varieties generally grown from seed of the most popular kinds cultivated in the United States. Cotton is valued according to the degree in which it possesses the special characteristics that best adapt it to the use for which it is intended. The qualities chiefly considered in classifying cotton are —LENGTH OF STAPLE, REGULARITY OF STAPLE IN DIAMETER AND LENGTH, FINENESS, STRENGTH, SMOOTHNESS, COLOUR, AND CLEANLINESS. American varieties are classed in four qualities. good ordinary, low middling, middling, and good middling, South American, three—middling fair, fair, and good fair; Egyptian, two—fair, and good fair. East Indian, three—fair, good fair, and good. Standard samples of these classes are preserved for reference, in case of dispute, in the office of the Liverpool Cotton Brokers' Association; and it is customary amongst brokers to form a set of the classes in which they deal, and, after careful comparison with the standards, to preserve them for easy reference when required As, however, the crop of each succeeding year differs in some important respects from its predecessor, these standard samples are subject to considerable modification. According to the relative abundance or scarcity, fulness or deficiency, of special characteristics, the different varieties are classed up or down, as the case may require. Thus, within a limited range, there is a constant fluctuation of the standard.

TABLE OF LENGTHS AND DIAMETERS OF COTTON FIBRES.

Name.	Lengths in Inches and Decimals.						Diameters in Decimals of an Inch.				
	Evan Leigh.	Monie	Alcan.	O'Neill.	Deschamps.	Bowman	Evan Leigh.	Alcan.	Roney.	Monie	Deschamps.
Sea Islands ...	1·62	1·8	...	...	..	...	·00064	·00025— 00056	·000437	·000135	·000256
Edisto	2 2	...	1 37—1·57	1 35—1 88	2 28	2·2	...	...	...	...	...
Wodamalam	1 63	...	...	1 44	...	...	...	...	...	..	...
John's Isle ..	1·6	...	...	1·5	...	...	...	...		...	...
Florida	..	1·65	...	...	...	1·95	...	...	...	000637	...
Fiji	...	1·87	..	...	2 01	1·88	...	..	...	·000637	·000677
Tahiti	.	1·5	...	..	..	1 88	...	..	...	000641	..
Peruvian	...	1·56	...	...	...	1 5	...	00052—·00078	·000437	·000675	...
Egyptian	1·41	...	1·1,—1 51	1·13—1 18	1·25	...	·000655	·00065—·00078	·000437	...	000763
Gallini	...	1·43	...	..	...	1 5	...	.	...	·000675	...
Brown	...	1·31	...	...	...	1 4	...	...	...	·00073[illegible]	...
White	...	1·25	...	...	...	1·25	...	...	...	·000[illegible]69	...
Smyrna	...	1·0		...	...	1 24	...	...	...	·000769	·00103
Brazilian	...	..	...	..	...	...	·00079	00065— 00078	...	...	...
Maranham ..	1·15	1·06	..	1·12—1 2	...	1·15	...	...	..	·000787	...
Pernambuco	...	1 25	..	1 18	...	1 35	...	..	..	·000787	·000819
Surinam	1·17	...	1·06—1 18	...	...	...	...	...	...	...	...
Parita	1·2	...	1 11	...	...	1 2	...	...	. .	...	...
Cera	1·15	1·03	1·11	...	...	1·15	...	...	...	·000787	...
Maceo	...	...	1·11	...	...	1·2	...	...	...	...	...
Peruvian											
Rough	1·3	1·28	0·86—1·18	...	1·13	1·3	...	...	...	...	·000846
Smooth	1·3	1·28	0·86—1·18	...	1·13	1·35	...	...	...	...	·000846

Algiers	1·45	...	1·41—1·57	...	...	...	...	...	...	...	
West Indian ..	1·3	1·22	...	...	...	1·3	...	...	...	·000769	...
American	...	...	..	...	...	...	·000775	000874	...	...	000826
Orleans	...	1·03	...	..	...	1·1	...	...	...	·000757	...
Uplands	...	0·93	..	...	...	1·0	...	...	...	·000763	...
Texas	0·92	1·0	..	..	...	0·95	...	..	·000547	·000763	...
Mobile	1·05	0·87	..	1·03	0·92	1 05	...	...	..	·000763	...
Georgia	1·05	...	..	1·03	0·92	...	..	·00025 ·00056	...	...	..
Mississippi ..	1 1	...	0·7—0·98	...	1·03	..	...	...	·000547	...	..
Louisiana	1 1	...	0 82—1·05	0·97—0·99	...	...	...	..	...	..	.
Tennessee ..	0·98.	...		1 0	...	...	...	..	·000586 — ·0006	...	..
African	1·15	1·03	...	1·1	...	0·91—1·25	...	...	...	·000819	...
Indian	...	...	..	...	...	...	·00073 — ·000844	...	·000736	...	..
Hingunghat..	...	1·03	...	.	..	1·2	.	...	...	·000833	·000787
Dhollerah ..	1·1	0·93	1·06—1·96	0·92—0·94	0·9	1 1	...	..	...	·000847	..
Broach	0 82	0·84	0·78— 0 82	...	0 78	0·9	...	..	...	·000833	·000885
Tinevelly	0·75—1·05	0 87	...	..	...	0 95	..	.	...	·000826	...
Dharwar ...	0 98	0 81	...	..	...	1 0	.	...	...	·000826	...
,,	1 0—1·65	..	1·18—1·37	...	..	...	.	...	...	...	...
Oomrawuttee	...	0·9	...	...	...	1 0	..	...	...	·000847	·000846
Comptah	...	0·87	..	0·9	...	1·05	.	...	...	·000847	..
Madras, West	0·85	0·87	0·71—0·9	...	0·82	1·0	..	...	...	·000833	·000885
Scinde	..	0·65	...	..	...	1 0	..	...	...	·00084	...
Bengal	1·15	0·87	...	...	...	1·1	...	...	...	·000869	·000996
China	...	...	0·83	...	0·86	...	...	...	...	...	·000949

A List of Cottons, their Characteristics and Suitability for Spinning Different Numbers of Yarn.

Kind of Cotton.	Description.	Suitable for
SEA ISLANDS	The varieties are enumerated on pages 170 and 171. Its fibre is the most valued among cottons, being long, fine, soft, and silky; it has a fairly regular fibre, especially the American variety. The Fiji and Tahiti varieties are uncertain in their staple. The shorter Sea Islands cotton mix well with the better class of Egyptian.	Sea Islands:—120's upwards twist or weft. Florida and Fiji:—For twist or weft up to 200's. Peruvian:—Twist or weft up to 150's.
EGYPTIAN	A valuable class of cotton, generally silky, but strong and tough. Gallini is the best, followed by Brown Egyptian. White Egyptian is strong and pliable, but slightly harsh. The softer Egyptian mixes with American (Peeler's).	Gallini:—Twist and weft up to 150's generally. Brown E.:—Twist and weft 50's to 130's. White E.—Up to 70's for twist and weft.
BRAZILIAN	A class of mixed cottons containing both harsh and soft qualities. The harsh wiry kinds have a good appearance and are clean. they mix well with wool for hosiery purposes. The softer Peruvian cotton is soft and pliable, and its colour enables it to mix well with Orleans.	Rough Peruvian:—Twist up to 70's. Smooth Peruvian:—Weft up to 70's. Other Varieties:—Up to 60's twist or weft.
AMERICAN	The staple cotton of the world. Owing to the extent of territory over which the cotton is cultivated a large number of varieties are grown, differing more or less in details. Orleans is ths most important and is very regular in strength and staple, as well as being soft and elastic.	Orleans.—Twist and weft up to 50's. Uplands:—Weft up to 40's. Mobile:—Weft up to 30's. Texas:—Twist or weft up to 50's.
INDIAN	A short fibred class of cotton used only for the low grades of work. As a rule it is strong but dirty. The better classes, such as Hingunghat, can be mixed with American.	Most of the varieties are suitable for twist, and range in numbers from Scinde up to 12's twist and Hingunghat up to 28's twist. A few varieties are suitable for weft, notably Broach Dholleral and Comptah.
OTHER VARIETIES OF COTTON	There are several other kinds of cotton grown, but only to a limited extent. They are of fairly good quality, and such cotton as West Indian, African, Smyrna, can be used for numbers varying from ..... Asiatic cotton is used extensively in Russia.	30's to 46's twist or weft.

ENGLISH WEIGHTS AND MEASURES OF COTTON YARNS.

24 Grains .. .. .. = 1 Pennyweight (Dwt. Troy).
18 Dwts. 5½ grains or (457·5 grs.) = 1 Ounce (Oz Avoirdupoise).
16 Ounces (7,000 grs) .. .. = 1 Pound (Lb. „)
54 inches = 1 thread or circumference of wrap reel.
4,320 „ = 80 threads or 1 lea or skein.
30,240 „ = 560 threads or 7 leas or 1 hank or 840 yards.

The number of hanks in 1 lb. is the count of cotton yarns.

A bundle of cotton yarn is as many hanks as make 10 lbs. in weight.

The numbers by which sewing cotton threads are sold represent three threads of the count twisted together—that is, No. 60's standard thread has three strands of No. 60's yarn in it.

In a six-cord thread each of the three strands is made up of two threads twisted together.

Six threads of No. 120's make six-cord 120's.

FRENCH WEIGHTS AND MEASURES OF COTTON YARNS.

The French system of numbering is based on the metric system—the metre (39 37 inches) and the kilogramme (2·204 lbs.) being their standards of length and weight.

In numbering yarn, a thread of cotton yarn 1,000 metres long weighing 500 grammes (½ kilo.), is called No. 1's.

No. 2 = 2,000 metres, weighing 500 grammes.
„ 3 = 3,000 „ „ 500 „
„ 4 = 4,000 „ „ 500 „

and so on. This length of 1,000 metres is termed a hank (or écheveau), and each hank is divided into 10 skeins (échevettes) of 100 metres each. These skeins are wrapped on a reel having a circumference of 1,425 metres (56·1 inches), making seventy revolutions to a skein.

The number of hanks in 500 grammes is the count of cotton yarn.

RULE.—Divide the metres reeled by twice the weight in grammes = counts French.

CONVERSION OF ENGLISH INTO FRENCH COUNTS OF COTTON YARN.

RULE.—To change English counts to French counts divide the English counts by 1·18

English Counts	French Counts	English Counts	French Counts	English Counts	French Counts	English Counts	French Counts
1	0,85	24	20,33	54	45 74	100	84,70
2	1,69	25	21,27	56	47,43	110	93,17
3	2,54	26	22,02	58	49,13	120	101,64
4	3,39	27	22,87	60	50,82	130	110,11
5	4,23	28	23,72	62	52,51	140	118,58
6	5,08	29	24,56	64	54,21	150	127,05
7	5,93	30	25,41	66	55 90	160	135,52
8	6,78	31	26,26	68	57,60	170	143,99
9	7,62	32	27,10	70	59,30	180	152,46
10	8,47	33	27,95	72	60,99	190	160,93
11	9,32	34	28,80	74	62,68	200	169,40
12	10,16	35	29,65	76	64,37	210	177,87
13	11,01	36	30,49	78	66,07	220	186,34
14	11,86	37	31,34	80	67,76	230	194,81
15	12,70	38	32,19	82	69,45	240	203,28
16	13,55	39	33,03	84	71,15	250	212,75
17	14,40	40	33,88	86	72,84	260	222,82
18	15,25	42	35,57	88	74,54	270	228,69
19	16,09	44	37,27	90	76,23	280	237,16
20	16,94	46	38,96	92	77,92	290	245,63
21	17,79	48	40,56	94	79,62	300	254,10
22	18,63	50	42,35	96	81,31	400	338,80
23	19,48	52	44,04	98	83,00	500	423,50

CONVERSION OF FRENCH INTO ENGLISH COUNTS OF COTTON YARN.

RULE.—To change French counts to English counts: multiply the French counts by 1·18.

French Counts	English Counts	French Counts	English Counts	French Counts	English Counts	French Counts	English Counts
1	1 3/16	24	28 1/4	54	63 3/4	100	118
2	2 3/8	25	29 1/2	56	66	110	130
3	3 1/2	26	30 3/4	58	68 1/2	120	141 3/4
4	4 3/4	27	31 7/8	60	70 3/4	130	153 1/2
5	5 7/8	28	33	62	73 1/4	140	165 1/4
6	7 1/16	29	34 1/4	64	75 1/2	150	177
7	8 1/4	30	35 1/2	66	78	160	189
8	9 7/16	31	36 3/8	68	80 1/4	170	200 3/4
9	10 5/8	32	37 3/4	70	82 3/4	180	212 1/2
10	11 3/4	33	39	72	85	190	224 1/4
11	13	34	40 1/8	74	87 1/4	200	236
12	14 1/8	35	41 1/4	76	89 3/4	210	248
13	15 3/8	36	42 1/2	78	92	220	259 3/4
14	16 1/2	37	43 1/2	80	94 1/2	230	271 1/2
15	17 3/4	38	44 5/8	82	96 3/4	240	283 1/4
16	18 7/8	39	46	84	99 1/4	250	295
17	20	40	47 1/4	86	101 1/2	260	307
18	21 1/4	42	49 1/2	88	104	270	318 3/4
19	22 1/2	44	52	90	106 1/4	280	330 1/2
20	23 5/8	46	54 1/4	92	108 1/2	290	342 1/4
21	24 3/4	48	56 3/4	94	111	300	354
22	26	50	59	96	113 1/4	400	472
23	27 1/8	52	61 1/2	98	115 3/4	500	590

SQUARE ROOTS.

No.	Square Root	No.	Square Root	No.	Square Root	No.	Square Root
0 0625	0·250	0·59	0·768	0·95	0·975	7·5	2·739
0·125	0·353	0·60	0·775	0 96	0·980	8·0	2·828
0·1875	0·433	0 61	0 781	0·97	0·985	8·5	2·915
0·25	0·500	0·62	0 787	0·98	0 990	9·0	3·0
0·26	0 510	0 625	0 790	0 99	0·995	9·5	3·082
0·27	0·520	0·63	0·794	1 0	1·0	10·0	3·162
0·28	0·529	0 64	0·800	1·10	1·049	10·5	3·243
0 29	0·539	0·65	0·806	1·125	1·066	11·0	3·316
0·30	0·548	0·66	0·812	1 20	1·095	11·5	3·391
0·31	0 557	0 67	0·819	1 25	1·118	12·0	3·464
0 3125	0·559	0 68	0·825	1 30	1·140	12·5	3·535
0 32	0·566	0·6875	0·829	1·375	1·172	13·0	3 605
0·33	0·574	0 69	0 831	1·40	1·183	13·5	3·674
0·34	0 583	0·70	0 837	1·50	1·224	14 0	3·741
0·35	0·592	0·71	0 843	1 60	1·265	14·5	3·807
0 36	0·600	0·72	0·849	1 625	1·274	15 0	3·872
0·37	0 608	0·73	0 854	1·70	1·304	15 5	3 937
0·375	0 612	0·74	0 860	1 75	1·322	16·0	4 0
0·38	0 616	0 75	0 866	1·80	1·342	16·5	4·062
0 39	0·624	0·76	0 872	1·875	1·369	17·0	4·123
0·40	0·632	0 77	0 878	1·90	1·378	17·5	4·183
0 41	0·640	0·78	0·883	1 95	1·396	18·0	4 242
0 42	0 648	0 79	0·889	2 0	1·414	18·5	4·301
0·43	0·656	0·80	0·894	2·20	1·483	19·0	4·358
0·4375	0·661	0 81	0·900	2·25	1·5	19·5	4·416
0·44	0·663	0·8125	0·901	2 40	1·549	20	4·472
0·45	0·671	0·82	0.906	2·50	1·581	21	4·582
0·46	0·678	0 83	0 911	2·75	1 658	22	4·690
0 47	0·686	0 84	0·917	3·0	1·732	23	4·795
0 48	0·693	0 85	0·922	3·25	1·802	24	4·898
0·49	0·700	0·86	0 927	3·50	1 870	25	5·0
0 50	0·707	0·87	0·933	3 75	1·936	26	5·099
0·51	0·714	0 875	0·935	4·0	2·0	27	5·196
0 52	0·721	0·88	0 938	4·25	2·061	28	5·291
0·53	0·728	0·89	0 943	4·50	2 121	29	5 385
0·54	0·735	0 90	0·949	4·75	2 179	30	5·477
0·55	0·742	0·91	0·954	5·0	2 236	31	5·567
0·56	0·748	0·92	0·959	5·5	2·345	32	5·656
0 5625	0·750	0 93	0 964	6·0	2·449	33	5·744
0·57	0·755	0·9375	0·968	6 5	2·550	34	5·830
0·58	0·762	0·94	0·970	7·0	2·645	35	5·916

Square Roots.

No.	Square Root.	No.	Square Root.	No.	Square Root.	No.	Square Root.
36	6 0	78	8 831	120	10·954	162	12·727
37	6·082	79	8 888	121	11·0	163	12·767
38	6·164	80	8·944	122	11·045	164	12·806
39	6·245	81	9·0	123	11·090	165	12 845
40	6·324	82	9·055	124	11 135	166	12·884
41	6·403	83	9 110	125	11·180	167	12·922
42	6·480	84	9 165	126	11·224	168	12·961
43	6·557	85	9 219	127	11·269	169	13·0
44	6 633	86	9 273	128	11·313	170	13·038
45	6 708	87	9 327	129	11·357	171	13·076
46	6·782	88	9·380	130	11 401	172	13·114
47	6·855	89	9·433	131	11 445	173	13·152
48	6·928	90	9·486	132	11 489	174	13 190
49	7 0	91	9·539	133	11·532	175	13·228
50	7·071	92	9·591	134	11·575	176	13·266
51	7·141	93	9 643	135	11 618	177	13 304
52	7·211	94	9 695	136	11·661	178	13·341
53	7 280	95	9 746	137	11·704	179	13 379
54	7 348	96	9·797	138	11·747	180	13 416
55	7 416	97	9 848	139	11·789	181	13 453
56	7·483	98	9·899	140	11·832	182	13 490
57	7·549	99	9 949	141	11 874	183	13 527
58	7·615	100	10 0	142	11 916	184	13 564
59	7·681	101	10·049	143	11·958	185	13·601
60	7·745	102	10 099	144	12·0	186	13 638
61	7 810	103	10.148	145	12 041	187	13 674
62	7 874	104	10·198	146	12 083	188	13 711
63	7 937	105	10 246	147	12·124	189	13 747
64	8·0	106	10 295	148	12·165	190	13·784
65	8·062	107	10·344	149	12·206	191	13·820
66	8 124	108	10·392	150	12·247	192	13·856
67	8·185	109	10·440	151	12·288	193	13·892
68	8·246	110	10·488	152	12·328	194	13·928
69	8 306	111	10·535	153	12·369	195	13 964
70	8·366	112	10·583	154	12 409	196	14·0
71	8·426	113	10 630	155	12·449	197	14·035
72	8·485	114	10 677	156	12·490	198	14 071
73	8·544	115	10 723	157	12·529	199	14·106
74	8·602	116	10·770	158	12·569	200	14·142
75	8·660	117	10 816	159	12·609		
76	8·717	118	10 862	160	12·649		
77	8·774	119	10·908	161	12·688		

MULTIPLIERS FOR TWIST OR TURNS PER INCH FOR FLY FRAMES.

(Slubbers, Intermediates, Rovers, and Jacks).

INDIAN AND LOW AMERICAN COTTON.

Slubbers	.. .. ..	Square root of hank roving multiplied by	1.3
Intermediates	.. ..	" " "	1·2
Rovers	.. .. ..	" " "	1·5

AMERICAN AND LOW EGYPTIAN COTTON

Slubbers	.. .. ..	Square root of hank roving multiplied by	1·0
Intermediates	.. ..	" " "	1·16
Rovers	.. ..	" " "	1·25
Jacks (Egyptian)	.. ..	" " "	0·9

GOOD EGYPTIAN AND SEA ISLANDS COTTON.

Slubbers	.. .. .	Square root of hank roving multiplied by	0.7
Intermediates	.. ..	" " "	0·78
Rovers	.. ..	" " "	1·1
Jacks (Egyptian)	.. .	" " "	0·9
" (Sea Islands)	..	" " "	0·95

Table for calculating Lengths of Fillets required to cover various sizes of Cylinders, Doffers, Rollers, etc.

Width of Engine on Wire.	Breadths of Fillets.									
	¼ Inch	⅜ Inch	1 Inch	1⅛ Inch	1¼ Inch	1⅜ Inch	1½ Inch	1⅝ Inch	1¾ Inch	2 Inch
Ins.										
36	18·849	12·566	9·4248	8·3772	7 5398	7·18	6·2832	5 7998	5·3856	4·7124
37	19·373	12·915	9·6866	8·6099	7 7492	7·38	6·4578	5·9609	5·5352	4·8433
38	19·896	13·264	9·9484	8·8426	7 9587	7·5797	6·6323	6·1221	5 6848	4·9742
39	20·42	13·613	10·2102	9·0753	8·1681	7·7791	6·8068	6·2832	5·8344	5·1051
40	20·944	13·962	10·472	9·308	8·3776	7·9787	6 9814	6·4443	5·984	5·236
41	21·467	14 311	10·7338	9·5407	8·587	8·1781	7 1559	6·6054	6·1336	5·3669
42	21·991	14 66	10·9956	9·7734	8 7964	8·3775	7 3304	6 7665	6·2832	5·4978
43	22 514	15·01	11·2574	10·0061	9·0059	8 577	7·505	6·927	6·4328	5·6287
44	23·038	15·359	11·5192	10 2388	9·2153	8·7765	7·6795	7·0887	6·5824	5·7596
45	23·562	15·708	11·781	10·4715	9·4248	8·9759	7·854	7·2498	6·732	5·8905
46	24·085	16 057	12·0428	10·7042	9·6342	9·1754	8·0286	7·4109	6·8816	6·0214
47	24·619	16·406	12·3046	10 9369	9·8436	9·3749	8·2031	7·5721	7·0312	6·1523
48	25 132	16 755	12·5664	11·1696	10·053	9·5743	8·3776	7·7332	7·1808	6·2832
49	25·656	17·104	12·8282	11·4023	10 262	9·7738	8·5522	7·8943	7·3304	6·4141
50	26·18	17·453	13·09	11·635	10·472	9·9733	8·7267	8·0553	7·48	6·545
51	26·703	17·802	13·3518	11·8677	10·681	10·1727	8·9012	8 2164	7 6296	6·6759

Rule.—Find on the first column of Table Width of Engine, and on top line Breadth of Fillet with which the Cylinders, etc., are to be covered. The figures under the Breadth of Fillet and in the same column opposite Width of Engine, give the constant required; multiply Diameter of Cylinder, etc., by Constant and the result gives length of Fillet necessary, in feet.

Example:—Doffer 38 in. on Wire × 24 in. diameter to be covered with 1¼ in. Fillet:—Constant 6·6323 × 24 = 159·175; say 159 feet, the length required.

TABLE OF DIVIDENDS.

For ascertaining the Weight of Hank or decimal part of a Hank.

RULE.—Divide 7,000 grains (1 lb of yarn) by 840 yards = dividend for 1 yard.

Yards.	Dividends	Yards.	Dividends.
1	8 333	10	83 333
2	16 666	15	125·000
3	25·000	20	166 666
4	33 333	30	250 000
5	41·666	40	333 333
6	50 000	60	500·000
7	58 333	80	666 666
8	66 666	100	833 333
9	75·000	120	1000 000

EXAMPLES.

If 2 yards of card sliver weigh 80 grains, what hank is it? Divide the dividend for 2 yards by 80 = 0·208 hank.

If 30 yards of roving frame roving weigh $6\frac{1}{2}$ grains what hank is it? Divide the dividend for 30 yards by $6\frac{1}{2}$ = 4 hank roving.

What ought 60 yards of a $4\frac{1}{2}$ hank roving to weigh? Divide the dividend for 60 yards by $4\frac{1}{2}$ = 111 grains.

YARN TABLE OF TWIST PER INCH AND SQUARE ROOT OF COUNTS.

RULES.

INDIAN AND AMERICAN COTTON.

Mule twist	Multiply square root of counts by			3·75
Mule weft	"	"	"	3·25
Ring frame twist	"	"	"	4·00
" " weft	"	"	"	3·25

EGYPTIAN COTTON.

Mule twist	Multiply square root of counts by			3·606
Mule weft	"	"	"	3·183
Ring frame twist	"	"	"	3·606
" " weft	"	"	"	3·25

Counts.	Square Root of Counts.	Indian and American Cotton			Egyptian Cotton.		
		Mule Twist	Mule and Ring Frame Weft.	Ring Frame Twist.	Mule Twist.	Mule Weft.	Ring Frame Twist.
1	1·000	3·75	3·25	4 00			
2	1·414	5·30	4·60	5·65			
3	1·732	6·49	5·62	6·92			
4	2·000	7 50	6 50	8 00			
5	2 236	8 38	7 26	8 94			
6	2·449	9·18	7 96	9 79			
7	2·645	9·92	8·59	10 58			
8	2·828	10·60	9·19	11 31			
9	3·000	11·25	9·73	12·00			
10	3·162	11·85	10 27	12 64	11·41	10·10	11·41
11	3·316	12 43	10 77	13 26	11 95	10·55	11·95
12	3·464	12·99	11·25	13 85	12 47	11·01	12·47
13	3·605	13·52	11·71	14 42	13·00	11·57	13·00
14	3·741	14 03	12·16	14·96	13 46	11·89	13·46
15	3·872	14·52	12 48	15·49	13·96	12·32	13·98
16	4·000	15·00	13 00	16·00	14·40	12·72	14·40
17	4 123	15·46	13·40	16·49	14 86	13 12	14·86
18	4 242	15·90	13·78	16·97	15·27	13·48	15·27
19	4·358	16·34	14 16	17·43	15·71	13·87	15·71
20	4·472	16 77	14·53	17 88	16·09	14·21	16·09
22	4 690	17·58	15·24	18·76	16 88	14·91	16·88
24	4·898	18·37	15 92	19·59	17·63	15·57	17·63
26	5·099	19·11	16 57	20·39	18·35	16·21	18 35
28	5·291	19·84	17·19	21 16	19·04	16·83	19·04
30	5 477	20·54	17·80	21·90	19·75	17·42	19 75
32	5·656	21·21	18·38	22·62	20·40	18·00	20·40
34	5·830	21 86	18·95	23·32	21·02	18·55	21·02
36	6·000	22·50	19·50	24·00	21·64	19·09	21·64
38	6·164	23·11	20·03	24·65	22·23	19·61	22·23
40	6·324	23·71	20·55	25·29	22·81	20·13	22·81

Yarn Table of Twist.

Counts.	Square Root of Counts.	Indian and American Cotton.			Egyptian Cotton.		
		Mule Twist.	Mule and Ring Frame Weft.	Ring Frame Twist	Mule Twist.	Mule Weft.	Ring Frame Twist.
42	6·480	24 30	21 06	25·92	23 37	20·62	23·37
44	6·633	24 87	21·55	26·53	23·94	21·10	23 92
46	6·782	25 43	22 04	27 12	24 45	21·58	21 45
48	6 928	25 98	22·51	27 71	24 98	22 04	24·98
50	7 071	26 51	22 98	28 28	25 50	22 50	25 50
52	7·211				26·00	22·94	26 00
54	7 348				26 50	23·38	26 50
56	7 483				26·98	23·81	26·98
58	7·615				27·46	24 23	27·46
60	7 745				27·93	24 54	27 93
62	7 874				28 39	25 05	28·39
64	8 000				28 85	25·45	28 85
66	8 124				29 29	25·87	29·29
68	8·246				29·73	26 23	29 73
70	8·366				30·17	26 62	30·17
72	8·485				30 60	27 00	30 60
74	8·602				31·02	27·37	31·02
76	8 717				31·44	27 74	31 44
78	8 831				31 85	28 10	31 85
80	8 944				32 25	28·47	32·25
82	9 055				32·65	28·81	32 65
84	9·165				33·05	29·16	33 05
86	9·273				33·44	29 50	33 44
88	9·380				33·83	29 84	33 83
90	9 486				34 21	30·18	34 21
92	9·591				34·59	30 52	34·59
94	9 695				34 96	30 85	34·96
96	9 797				35·33	31·17	35·33
98	9 899				35 70	31·50	35·70
100	10 000				36·06	31·83	36·06
102	10 099				36·41	32 14	36 41
104	10 198				36 77	32 46	36·77
106	10 295				37·12	32 76	37 12
108	10 392				37 47	33·07	37 47
110	10 488				37 81	33·32	37·81
112	10 583				38·16	33 68	38·16
114	10·677				38 50	33 98	38 50
116	10 770				38 83	34·28	38·83
118	10·862				39·17	34 57	39·17
120	10·954				39·50	34·86	39 50

WEIGHT OF YARN OF DIFFERENT COUNTS FOR 1, 2 AND 3 LEAS.

1 Lea = 120 Yards = 80 Threads.

USEFUL FOR NUMBERING YARNS.

Counts.	1 Lea.			2 Leas			3 Leas.		
	Oz.	dwts.	grs.	Oz.	dwts.	grs.	Oz.	dwts.	grs.
1	2	5	5·071	4½	1	7·267	6½	6	12 338
2	1	2	14·535	2	5	5·071	3	7	19·606
3	½	4	18·649	1½	0	10 422	2	5	5·071
4	½	1	7·268	1	2	14·536	1½	3	21·704
5	0	8	8·114	½	7	13 353	1	6	18·592
6	0	6	22 762	½	4	18 649	1	2	14 536
7	0	5	22·939	½	2	19·033	½	8	17 912
8	0	5	5·071	½	1	7·267	½	6	12·339
9	0	4	15 174	½	0	3·474	½	4	18·649
10	0	4	4·057	0	8	8·114	½	3	9.296
11	0	3	18·961	0	7	13·022	½	2	6 008
12	0	3	11 381	0	6	22·762	¼	1	7 268
13	0	3	4 967	0	0	9 934	½	0	12·026
14	0	2	23·469	0	5	22·939	0	8	22·408
15	0	2	18·705	0	5	13 410	0	8	8·114
16	0	2	14·536	0	5	5 071	0	7	19 607
17	0	2	10 857	0	4	21 714	0	7	8·571
18	0	2	7·587	0	4	15 175	0	6	22 762
19	0	2	4 662	0	4	9 323	0	6	13·985
20	0	2	2 029	0	4	4 057	0	6	6·086
21	0	1	23 646	0	3	23 293	0	5	22·939
22	0	1	21 481	0	3	18 961	0	5	16·422
23	0	1	19 503	0	3	15·006	0	5	10·509
24	0	1	17 690	0	3	11 381	0	5	5·071
25	0	1	16 023	0	3	8·046	0	5	0·069
26	0	1	14·484	0	3	4 967	0	4	19·450
27	0	1	13 058	0	3	2·116	0	4	15·175
28	0	1	11·734	0	2	23·469	0	4	11·204
29	0	1	10·502	0	2	21·005	0	4	7.507
30	0	1	9·352	0	2	18·705	0	4	4·057
31	0	1	8·276	0	2	16·553	0	4	0·829
32	0	1	7·268	0	2	14·535	0	3	21·803
33	0	1	6·320	0	2	12 641	0	3	18·961
34	0	1	5·428	0	2	10·857	0	3	16·285

WEIGHT OF YARN OF DIFFERENT COUNTS FOR 4, 5, 6 AND 7 LEAS.

1 Lea = 120 Yards = 80 Threads.

USEFUL FOR NUMBERING YARNS.

Counts.	4 Leas.			5 Leas.			6 Leas.			7 Leas.		
	Oz.	dwts.	grs.	Oz.	dwts.	grs.	Oz.	dwts.	grs.	Oz.	dwts.	grs.
1	9	2	14·535	11	7	19 606	13½	3	21·801	16	0	0·000
2	4½	1	7·267	5½	3	21·803	6½	6	12·338	8	0	0·000
3	3	0	20·845	3½	5	15·493	4½	1	7·275	5	6	1 924
4	2	5	5·071	2½	6	12·339	3	7	19·607	4	0	0·000
5	1½	5	23·831	2	5	5·071	2½	4	10·310	3	3	15·549
6	1½	0	10·423	1½	7	9·185	2	5	5·071	2½	3	0·958
7	1	5	14·006	1½	2	10 070	1½	8	9 ·09	2	5	5·071
8	1	2	14·536	1	7	19·607	1½	3	21·804	2	0	0·000
9	1	0	6·948	1	4	22·123	1	0	10·423	1½	5	1 597
10	½	7	13·354	1	2	14 536	1	6	18·593	1½	1	19·775
11	½	6	0 969	1	0	17·055	1	4	12·016	1	8	6·977
12	½	4	18 649	½	8	6·030	1	2	14 536	1	6	1·917
13	½	3	16·993	½	6	21·960	1	1	0·052	1	4	5·719
14	½	2	19·003	½	5	18·472	½	8	17·941	1	2	14·536
15	½	1	23·944	½	4	18·649	½	7	13·354	1	1	5·183
16	½	1	7·268	½	3	21 804	½	6	12·339	1	0	0·000
17	½	0	16·554	½	3	3·411	½	5	14·268	½	8	1·125
18	½	0	3·441	½	2	11·062	½	4	18·649	½	7	2·236
19	0	8	18 647	½	1	20 433	½	4	1·095	½	6	5·757
20	0	8	8·114	½	1	7 268	½	3	9·296	½	5	11·325
21	0	7	22·585	½	0	19 256	½	2	19·003	½	4	18 649
22	0	7	13·922	½	0	½ 528	½	2	6·008	½	4	3·489
23	0	7	6·012	0	9	1·516	½	1	18·144	½	3	13·647
24	0	6	22·762	0	8	16 452	½	1	7·268	½	3	0·958
25	0	6	16·091	0	8	8·114	½	0	21·262	½	2	13·285
26	0	6	9·934	0	8	0·417	½	0	12·026	½	2	2·509
27	0	6	4·233	0	7	17·291	½	0	3·474	½	1	16·532
28	0	5	22·939	0	7	10·673	0	8	22·408	½	1	7·268
29	0	5	18·010	0	7	4·512	0	8	15·015	½	0	22·642
30	0	5	13·409	0	6	22·762	0	8	8·114	½	0	14·597
31	0	5	9·106	0	6	17·382	0	8	1·659	½	0	7·060
32	0	5	5·071	0	6	12·339	0	7	19·607	½	0	0·000
33	0	5	1·281	0	6	7·602	0	7	13·922	0	8	20·242
34	0	4	21·741	0	6	3·143	0	7	8·571	0	8	14·000

Weight of Yarn of Different Counts for 1, 2 and 3 Leas.

Counts.	1 Lea.			2 Leas.			3 Leas.		
	Oz.	dwts.	grs	Oz	dwts.	grs.	Oz.	dwts.	grs.
35	0	1	4·588	0	2	9·176	0	3	13·763
36	0	1	3·793	0	2	7·587	0	3	11·381
37	0	1	3·042	0	2	6·085	0	3	9·127
38	0	1	2·331	0	2	4 661	0	3	6·992
39	0	1	1·656	0	2	3·311	0	3	4·967
40	0	1	1·014	0	2	2·028	0	3	3·043
41	0	1	0·404	0	2	0 808	0	3	1·213
42	0	0	23·823	0	1	23·646	0	2	23·469
43	0	0	23·269	0	1	22·538	0	2	21 807
44	0	0	22·740	0	1	21·480	0	2	20·221
45	0	0	22·235	0	1	20·470	0	2	18 705
46	0	0	21·751	0	1	19·503	0	2	17 254
47	0	0	21·289	0	1	18·577	0	2	15 866
48	0	0	20·845	0	1	17·690	0	2	14 535
49	0	0	20·420	0	1	16·840	0	2	13 259
50	0	0	20 011	0	1	16·023	0	2	12·034
51	0	0	19·619	0	1	15·238	0	2	10·857
52	0	0	19·242	0	1	14·483	0	2	9·725
53	0	0	18·879	0	1	13·757	0	2	8·636
54	0	0	18·529	0	1	13 058	0	2	7 587
55	0	0	18·192	0	1	12·384	0	2	6·577
56	0	0	17·867	0	1	11·734	0	2	5·602
57	0	0	17·554	0	1	11·108	0	2	4 662
58	0	0	17·251	0	1	10·502	0	2	3 753
59	0	0	16·959	0	1	9·918	0	2	2·876
60	0	0	16·676	0	1	9·352	0	2	2·028
61	0	0	16·403	0	1	8·806	0	2	1·208
62	0	0	16·138	0	1	8·276	0	2	0·413
63	0	0	15 882	0	1	7·764	0	1	23·646
64	0	0	15·634	0	1	7·268	0	1	22·902
65	0	0	15·393	0	1	6·787	0	1	22·180
66	0	0	15·160	0	1	6·320	0	1	21·480
67	0	0	14·934	0	1	5·868	0	1	20 802
68	0	0	14·714	0	1	5·428	0	1	20·142
69	0	0	14·501	0	1	5·002	0	1	19·503
70	0	0	14·294	0	1	4·588	0	1	18·881
71	0	0	14·093	0	1	4·185	0	1	18·278
72	0	0	13·896	0	1	3·793	0	1	17·690
73	0	0	13·706	0	1	3·413	0	1	17·119

Weight of Yarn of Different Counts for 4, 5, 6 and 7 Leas.

Counts	4 Leas.			5 Leas.			6 Leas.			7 Leas.		
	Oz.	dwts.	grs.	Oz.	dwts.	grs.	Oz.	dwts.	grs.	Oz.	dwts.	grs.
35	0	4	18·351	0	5	22·939	0	7	3·527	0	8	8·114
36	0	4	15·174	0	5	18 968	0	6	22·762	0	8	2·555
37	0	4	12·170	0	5	15·212	0	6	18·255	0	7	21·297
38	0	4	9·323	0	5	11·654	0	6	13·985	0	7	16·316
39	0	4	6·662	0	5	8·278	0	6	9·934	0	7	11·589
40	0	4	4·057	0	5	5·071	0	6	6·085	0	7	7·100
41	0	4	1·617	0	5	2·021	0	6	2·425	0	7	2·829
42	0	3	23 292	0	4	23·115	0	5	22·939	0	6	22·762
43	0	3	21 076	0	4	20·346	0	5	19·615	0	6	18·884
44	0	3	18·961	0	4	17·701	0	5	16·441	0	6	15·182
45	0	3	16 939	0	4	15·174	0	5	13·409	0	6	11·664
46	0	3	15 006	0	4	12 758	0	5	10·509	0	6	8 261
47	0	3	13 155	0	4	10·444	0	5	7·732	0	6	5·021
48	0	3	11·381	0	4	8 226	0	5	5·071	0	6	1·916
49	0	3	9·679	0	4	6·099	0	5	2 519	0	5	22·939
50	0	3	8·045	0	4	4·057	0	5	0·068	0	5	20·080
51	0	3	6·476	0	4	2 095	0	4	21·714	0	5	17·333
52	0	3	4·967	0	4	0·208	0	4	19·450	0	5	14·692
53	0	3	3·515	0	3	22·394	0	4	17·272	0	5	12·151
54	0	3	2 116	0	3	22·645	0	4	15·174	0	5	9·703
55	0	2	0·769	0	3	18·961	0	4	13·153	0	5	7·345
56	0	2	23·469	0	3	17·366	0	4	11·204	0	5	5 071
57	0	2	22·216	0	3	15·769	0	4	9·323	0	5	2 877
58	0	2	21 005	0	3	14·256	0	4	7·507	0	5	0·758
59	0	2	19·835	0	3	12·794	0	4	5·753	0	4	22·712
60	0	2	18 704	0	3	11·381	0	4	4·057	0	4	20·733
61	0	2	17·611	0	3	10 014	0	4	2·417	0	4	18·820
62	0	2	16·553	0	3	8·691	0	4	0·829	0	4	16·967
63	0	2	15·528	0	3	7 410	0	3	23·293	0	4	15·175
64	0	2	14·536	0	3	6·169	0	3	21·803	0	4	13·437
65	0	2	13·574	0	3	4 967	0	3	20·360	0	4	11·754
66	0	2	12·640	0	3	3·801	0	3	18·961	0	4	10·121
67	0	2	11·731	0	3	2·670	0	3	17·603	0	4	8·537
68	0	2	10·857	0	3	1·571	0	3	16·285	0	4	7·000
69	0	2	10·004	0	3	0·505	0	3	15·006	0	4	5·507
70	0	2	9·175	0	2	23·469	0	3	13·763	0	4	4·057
71	0	2	8·370	0	2	22·463	0	3	12·555	0	4	2·648
72	0	2	7·587	0	2	21·484	0	3	11·381	0	4	1.277
73	0	2	6·826	0	2	20·532	0	3	10·239	0	3	23·945

Weight of Yarn of Different Counts for 1, 2 and 3 Leas.

Counts.	1 Lea.			2 Leas.			3 Leas.		
	Oz.	dwts.	grs.	Oz.	dwts.	grs.	Oz.	dwts.	grs.
74	0	0	13·521	0	1	3·042	0	1	16·563
75	0	0	13·341	0	1	2·682	0	1	16·023
76	0	0	13·165	0	1	2·330	0	1	15·496
77	0	0	12·994	0	1	1·989	0	1	14·983
78	0	0	12·828	0	1	1·655	0	1	14·483
79	0	0	12·665	0	1	1·331	0	1	13·996
80	0	0	12·507	0	1	1·014	0	1	13·521
81	0	0	12·352	0	1	0·704	0	1	13·057
82	0	0	12·202	0	1	0·404	0	1	12·606
83	0	0	12·055	0	1	0·110	0	1	12·165
84	0	0	11·911	0	0	23 823	0	1	11·734
85	0	0	11·771	0	0	23·543	0	1	11.314
86	0	0	11·634	0	0	23·269	0	1	10·903
87	0	0	11·501	0	0	23·002	0	1	10·502
88	0	0	11·370	0	0	22·740	0	1	10·110
89	0	0	11·242	0	0	22·485	0	1	9·727
9	0	0	11·117	0	0	22 235	0	1	9·352
91	0	0	10 995	0	0	21 991	0	1	8 986
92	0	0	10·875	0	0	21.751	0	1	8·627
93	0	0	10·759	0	0	21·518	0	1	8·276
94	0	0	10·644	0	0	21·288	0	1	7·933
95	0	0	10 532	0	0	21·065	0	1	7·597
96	0	0	10·422	0	0	20·845	0	1	7·267
97	0	0	10·315	0	0	20·630	0	1	6·945
98	0	0	10 210	0	0	20·420	0	1	6·629
99	0	0	10·107	0	0	20·213	0	1	6·320
100	0	0	10·005	0	0	20·011	0	1	6·017
101	0	0	9·907	0	0	19·813	0	1	5·72
102	0	0	9·809	0	0	19·619	0	1	5·428
104	0	0	9·621	0	0	19·243	0	1	4·862
106	0	0	9·439	0	0	18·878	0	1	4·318
108	0	0	9·264	0	0	18 529	0	1	3·793
110	0	0	9·096	0	0	18·192	0	1	3·288
112	0	0	8·933	0	0	17·867	0	1	2·801
11	0	0	8·777	0	0	17·554	0	1	2·331
116	0	0	8 625	0	0	17·251	0	1	1·876
118	0	0	8·479	0	0	16·959	0	1	1·438
120	0	0	8·338	0	0	16·676	0	1	1·014
122	0	0	8·201	0	0	16·403	0	1	0·604

Weight of Yarn of Different Counts for 4, 5, 6 and 7 Leas.

Counts.	4 Leas.			5 Leas.			6 Leas.			7 Leas.		
	Oz.	dwts.	grs.	Oz.	dwts	grs.	Oz.	dwts.	grs.	Oz.	dwts	grs.
74	0	2	6·085	0	2	19 606	0	3	9·127	0	3	22·648
75	0	2	5·364	0	2	18·705	0	3	8·045	0	3	21·380
76	0	2	4·661	0	2	17 827	0	3	6·992	0	3	20 158
77	0	2	3·978	0	2	16·972	0	3	5·966	0	3	18·961
78	0	2	3·331	0	2	16 139	0	3	4·967	0	3	17·794
79	0	2	2·662	0	2	15·327	0	3	3·992	0	3	16·658
80	0	2	2·028	0	2	14·535	0	3	3·042	0	3	15·550
81	0	2	1·409	0	2	13·761	0	3	2·113	0	3	14·465
82	0	2	0·808	0	2	13·010	0	3	1 212	0	3	13·414
83	0	2	0·220	0	2	12·275	0	3	0·330	0	3	12·386
84	0	1	23·646	0	2	11·557	0	2	23·469	0	3	11·381
85	0	1	23·086	0	2	10·857	0	2	22·628	0	3	10·400
86	0	1	22 538	0	2	10 173	0	2	21·807	0	3	9·442
87	0	1	22·003	0	2	9·504	0	2	21·005	0	3	8·506
88	0	1	21 480	0	2	8·850	0	2	20·220	0	3	7·591
89	0	1	20 969	0	2	8·212	0	2	19 454	0	3	6·697
90	0	1	20·469	0	2	7·587	0	2	18·704	0	3	5·822
91	0	1	19·981	0	2	6 976	0	2	17·972	0	3	4·967
92	0	1	19·503	0	2	6·379	0	2	17·254	0	3	4·130
93	0	1	19·035	0	2	5·794	0	2	16 552	0	3	3·312
94	0	1	18·577	0	2	5·222	0	2	15·866	0	3	2·510
95	0	1	18 129	0	2	4·661	0	2	15·194	0	3	1·726
96	0	1	17·690	0	2	4·113	0	2	14·535	0	3	0·958
97	0	1	17·261	0	2	3·576	0	2	13 891	0	3	0 206
98	0	1	16·839	0	2	3·049	0	2	13 259	0	2	23 469
99	0	1	16·427	0	2	2·534	0	2	12·640	0	2	22·747
100	0	1	16·022	0	2	2·028	0	2	12·034	0	2	22·040
101	0	1	15·627	0	2	1·533	0	2	11·440	0	2	21·346
102	0	1	15·238	0	2	1·047	0	2	10 857	0	2	20·666
104	0	1	14·483	0	2	0 104	0	2	9·725	0	2	19·346
106	0	1	13·757	0	1	23·197	0	2	8·636	0	2	18·075
108	0	1	13·058	0	1	22·322	0	2	7·587	0	2	16·851
110	0	1	12 384	0	1	21·480	0	2	6·576	0	2	15·672
112	0	1	11·734	0	1	20·668	0	2	5·602	0	2	14·535
114	0	1	11·108	0	1	19·884	0	2	4·661	0	2	13·438
116	0	1	10·502	0	1	19·128	0	2	3·753	0	2	12·379
118	0	1	9·917	0	1	18·397	0	2	2·876	0	2	11·356
120	0	1	9·352	0	1	17·690	0	2	2·028	0	2	10·366
122	0	1	8·805	0	1	17·007	0	2	1·208	0	2	9·410

Weight of Yarn of Different Counts for 1, 2 and 3 Leas.

Counts.	1 Lea.			2 Leas.			3 Leas.		
	Oz.	dwts.	grs.	Oz	dwts	grs.	Oz.	dwts.	grs.
124	0	0	8·069	0	0	16 138	0	00	0·207
126	0	0	7·941	0	0	15 882	0	0	23 823
128	0	0	7·817	0	0	15·634	0	0	23 451
130	0	0	7·696	0	0	15·393	0	0	23·090
135	0	0	7·412	0	0	14·823	0	0	22·235
140	0	0	7·147	0	0	14·294	0	0	21·440
145	0	0	6·900	0	0	13 800	0	0	20·700
150	0	0	6·670	0	0	13·341	0	0	20 011
155	0	0	6·455	0	0	12 910	0	0	19 365
160	0	0	6 253	0	0	12·506	0	0	18·759
165	0	0	6·063	0	0	12 126	0	0	18·189
170	0	0	5 885	0	0	11·770	0	0	17 655
175	0	0	5 717	0	0	11·434	0	0	17 151
180	0	0	5·558	0	0	11 116	0	0	16·674
185	0	0	5·408	0	0	10·816	0	0	16·224
190	0	0	5 266	0	0	10 532	0	0	15·798
195	0	0	5 130	0	0	10·260	0	0	15 390
200	0	0	5·002	0	0	10 004	0	0	15·006
205	0	0	4·880	0	0	9 760	0	0	14·640
210	0	0	4 764	0	0	9·528	0	0	14·292
215	0	0	4 653	0	0	9 306	0	0	13·959
220	0	0	4·547	0	0	9·094	0	0	13 641
225	0	0	4 446	0	0	8·892	0	0	13 338
230	0	0	4 350	0	0	8·700	0	0	13 050
235	0	0	4·257	0	0	8·514	0	0	12·771
240	0	0	4·164	0	0	8·328	0	0	12·492
245	0	0	4 083	0	0	8·166	0	0	12 249
250	0	0	4·002	0	0	8 004	0	0	12·006
255	0	0	3·923	0	0	7·846	0	0	11·769
260	0	0	3·848	0	0	7·696	0	0	11·544
265	0	0	3·775	0	0	7 550	0	0	11·325
270	0	0	3 706	0	0	7·412	0	0	11·118
275	0	0	3·638	0	0	7·276	0	0	10·914
280	0	0	3·573	0	0	7·146	0	0	10·719
285	0	0	3·510	0	0	7·020	0	0	10·530
290	0	0	3·450	0	0	6·900	0	0	10·350
295	0	0	3·391	0	0	6·782	0	0	10·173
300	0	0	3·335	0	0	6·670	0	0	10·005

Weight of Yarn of Different Counts for 4, 5, 6 and 7 Leas.

Counts.	4 Leas.			5 Leas.			6 Leas.			7 Leas.		
	Oz.	dwts.	grs.	Oz.	dwts.	grs.	Oz.	dwts.	grs.	Oz.	dwts.	grs.
124	0	1	8 276	0	1	16·345	0	2	0·414	0	2	8 483
126	0	1	7 764	0	1	15·705	0	1	23·646	0	2	7·587
128	0	1	7·268	0	1	15 084	0	1	22 901	0	2	6·718
130	0	1	6·787	0	1	14·483	0	1	22 180	0	2	5·877
135	0	1	5·646	0	1	13·058	0	1	20 470	0	2	3·881
140	0	1	4·587	0	1	11·734	0	1	18·881	0	2	2·028
145	0	1	3·600	0	1	10·500	0	1	17 400	0	2	0·300
150	0	1	2 682	0	1	9·352	0	1	16 022	0	1	22·693
155	0	1	1 820	0	1	8·275	0	1	14·730	0	1	21·185
160	0	1	1 012	0	1	7·265	0	1	13·518	0	1	19 771
165	0	1	0·252	0	1	6·315	0	1	12·378	0	1	18·441
170	0	0	23·540	0	1	5 425	0	1	11·310	0	1	17·195
175	0	0	22·868	0	1	4·585	0	1	10·302	0	1	16·019
180	0	0	22·234	0	1	3 790	0	1	9·348	0	1	14 906
185	0	0	21·632	0	1	3·040	0	1	8·448	0	1	13·856
190	0	0	21·064	0	1	2 330	0	1	7·596	0	1	12·862
195	0	0	20·520	0	1	1·650	0	1	6 780	0	1	11·910
200	0	0	20·008	0	1	1.010	0	1	6·012	0	1	11 014
205	0	0	19 520	0	1	0·400	0	1	5·280	0	1	10·160
210	0	0	19·056	0	0	23·820	0	1	4·584	0	1	9·348
215	0	0	18 612	0	0	23·265	0	1	3·918	0	1	8·571
220	0	0	18·188	0	0	22·735	0	1	3·282	0	1	7·829
225	0	0	17·784	0	0	22·230	0	1	2·676	0	1	7·122
230	0	0	17 400	0	0	21·750	0	1	2·100	0	1	6·450
235	0	0	17·028	0	0	21·285	0	1	1·542	0	1	5·799
240	0	0	16·656	0	0	20 820	0	1	0·824	0	1	5·148
245	0	0	16·332	0	0	20·415	0	1	0·498	0	1	4·581
250	0	0	16·008	0	0	20·010	0	1	0·012	0	1	4·014
255	0	0	15·692	0	0	19·615	0	0	23·538	0	1	3·461
260	0	0	15·392	0	0	19·240	0	0	23·088	0	1	2·936
265	0	0	15·100	0	0	18 875	0	0	22·650	0	1	2·425
270	0	0	14·82	0	0	18·530	0	0	22·236	0	1	1 942
275	0	0	14·552	0	0	18·190	0	0	21·828	0	1	1·466
280	0	0	14·292	0	0	17·865	0	0	21·438	0	1	1·011
285	0	0	14·040	0	0	17·550	0	0	21·060	0	1	0·570
290	0	0	13·800	0	0	17·250	0	0	20·700	0	1	0·150
295	0	0	13·564	0	0	16·955	0	0	20·346	0	0	23·737
300	0	0	13·341	0	0	16·675	0	0	20·010	0	0	23·345

CARDING, DRAWING, ROVING AND SPINNING TABLES.

The following tables shew the Size, Hank, and Proportion of Hank in every operation from the Lap Machines through all the various processes of Carding Drawing, Roving and Spinning

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EXPLANATION AND EXAMPLES

The first line in the Carding and Drawing Table is the decimal of the Hank according to its length and weight, which will be found in the following manner —Multiply all the drafts together as far as regards the operation you intend trying, whether it be Slubbing, Drawing or Carding, for a Dividend, and all the Doubling accordingly for a devisor, the quotient will be the draft then divide the numbers you are spinning or the numbers you wish to spin, by the net draft and the quotient will be the decimal of the Hank, opposite to which in the table you will have the weight according to the length weighed

EXAMPLE —Suppose the total draft to be 181,440, the doubling 1 728, and the numbers to be spun 40's, what weight will 2 yards of Carding or Doubling be? Thus 181,440 — 1,728 — 105 then 40 — 105 = 38, which is the decimal of a hank, opposite to which in the table under 2 yards, will be found 1 dwt 19 86 grains, the weight required

The Slubbing and Roving Tables rise progressively in 20th parts of a hank, as will be seen in the following tables.

CARDING AND DRAWING TABLE.

Decl of Hank	2 YARDS Dwts	2 YARDS Grains	4 YARDS Dwts	4 YARDS Grains	6 YARDS Dwts	6 YARDS Grains
050	13	21 33	27	18 66	41	16 00
055	12	15 03	25	6 06	37	21 09
060	11	13 77	23	3 55	34	17 39
065	10	16 41	21	5 82	32	1 23
070	9	22 09	19	20 19	29	18 20
075	9	6 22	18	1 17	27	18 6
080	8	16 33	17	8 66	26	1
085	8	4 07	16	8 15	24	12 23
090	7	17 18	15	10 37	23	3 55
095	7	7 43	14	14 87	21	22 31
098	7	2 06	14	4 13	21	6 20
099	7	0 35	14	0 70	21	1 05
100	6	22 06	13	21 30	20	20
101	6	21 01	13	18 03	20	15 07
102	6	19 31	13	14 79	20	10 19
103	6	17 81	13	11 62	20	5 73
104	6	16 45	13	8 91	20	76
105	6	14 72	13	5 46	19	20 19
106	6	13 23	13	2 46	19	15 69
107	6	11 76	12	23 52	19	11 29
108	6	10 32	12	20 64	19	6 96
109	6	8 90	12	17 81	19	2 71
110	6	7 51	12	15 03	18	22 57
111	6	6 15	12	12 30	18	18 75
112	6	4 81	12	9 62	18	17 76
113	6	3 49	12	6 98	18	10 77
114	6	2 19	12	4 39	18	6 59
115	6	0 92	12	1 85	18	2 78
116	5	23 67	11	23 35	17	23 03
117	5	22 45	11	20 90	17	19 35
118	5	21 24	11	18 48	17	15 72
119	5	20 05	11	16 11	17	12 16
120	5	18 88	11	13 77	17	8 66
121	5	17 74	11	11 18	17	5 22
122	5	16 61	11	9 22	17	1 83
123	5	15 50	11	7 00	16	22 50

Carding and Drawing Table.

2 YARDS.			4 YARDS.		6 YARDS.	
Decl. of Hank	Dwts.	Grains.	Dwts.	Grains.	Dwts.	Grains.
·124	5	14 40	11	4·81	16	19·22
·125	5	13 33	11	2·66	16	16·00
·126	5	12·27	11	0·55	16	12·82
·127	5	11 23	10	22·46	16	9 70
·128	5	10·20	10	20 41	16	6·63
·129	5	9·19	10	18 39	16	3·59
·130	5	8 20	10	16·71	16	0·60
131	5	7·22	10	14·45	15	21·67
·132	5	6 26	10	12·52	15	18·78
·133	5	5·31	10	10 62	15	15·93
·134	5	4·37	10	8·75	15	13 13
·135	5	4 45	10	6 91	15	10·37
·136	5	2·55	10	5·24	15	7·74
·137	5	1 65	10	3·31	15	4·96
·138	5	0 77	10	1 54	15	2·31
·139	4	33 90	9	23 80	14	23·70
·140	4	23 00	9	22·09	14	21·00
·141	4	22 20	9	20·40	14	18·60
·142	4	21 37	9	18·74	14	16·11
·143	4	20 55	9	17 10	14	13·65
·144	4	19 74	9	15·48	14	11·22
·145	4	18·94	9	13·88	14	8·82
·146	4	18·15	9	12·31	14	6·46
·147	4	17 37	9	10·75	14	4 13
·148	4	16·61	9	9·22	14	1·83
·149	4	15·85	9	7·71	13	23·57
·150	4	15·11	9	6 22	13	21·33
·151	4	14·37	9	4 75	13	19 12
·1525	4	13·29	9	2 57	13	15 86
·153	4	12·03	9	1·86	13	14·79
·155	4	11·52	8	23·05	13	10·58
157	4	10 15	8	20 31	13	6·47
·1575	4	9 82	8	19·60	13	5·46
·159	4	8·82	8	17 64	13	2·46
·160	4	8·16	8	16·33	13	0·50
·163	4	6·24	8	12·49	12	18 74

Carding and Drawing Table.

2 YARDS.			4 YARDS.		6 YARDS.	
Decl. of Hank.	Dwts.	Grains.	Dwts.	Grains.	Dwts.	Grains.
·165	4	5 10	8	10 20	12	15·03
·167	4	3 80	8	7·60	12	11·40
·170	4	2 00	8	4 08	12	6·11
173	4	0 33	8	0·67	12	1·01
·175	3	23·27	7	22 27	11	21·71
·179	3	21 10	7	18 21	11	15·32
·180	3	20 59	7	17 18	11	13·17
·183	3	19 07	7	14·14	11	9·22
·185	3	18 10	7	12·18	11	6·27
·187	3	17 12	7	10 25	11	3·38
·190	3	15 71	7	7 43	10	23·15
·193	3	14 35	7	4·71	10	19·06
·195	3	13 47	7	2 94	10	16·41
·197	3	12·60	7	1 20	10	13·80
·200	3	11 33	6	22·66	10	10·00
·203	3	10 10	6	20 20	10	5·30
·205	3	9·30	6	18 60	10	3·90
·207	3	8 51	6	17 03	10	1·54
·210	3	7·36	6	14 73	9	22·09
·213	3	6 24	6	12 49	9	18·74
·215	3	5 51	6	11 03	9	16·55
·217	3	4 80	6	9 61	9	14·41
·220	3	3 75	6	7·51	9	11·27
·223	3	2 73	6	5 46	9	8·21
·225	3	2 07	6	4 14	9	6·22
·227	3	1·42	6	2·84	9	4·26
·230	3	0 46	6	0 92	9	1·39
·233	2	23·53	5	23 06	8	22·59
·235	2	22·92	5	21·84	8	20·76
·237	2	22 32	5	20 64	8	18·97
·240	2	21·44	5	18 88	8	16·33
·243	2	20·58	5	17 17	8	13·76
·245	2	20 02	5	16 05	8	12·06
·247	2	19 47	5	14·95	8	10·42
·250	2	18 66	5	13·33	8	8·00
·253	2	17·87	5	11 75	8	5·62

Carding and Drawing Table.

2 YARDS.			4 YARDS.		6 YARDS.	
Decl. of Hank.	Dwts.	Grains.	Dwts.	Grains	Dwts.	Grains.
·255	2	17 36	5	10·71	8	4·07
·257	2	16 85	5	9·71	8	2·55
·260	2	16·10	5	8·20	8	0·30
·263	2	15·37	5	6 74	7	22·11
265	2	14·89	5	5 78	7	20 67
·270	2	13 72	5	3·45	7	17·18
·275	2	12·60	5	1·21	7	13·81
·280	2	11·52	4	23·04	7	10·57
·285	2	10 47	4	20 95	7	7·43
·290	2	9 47	4	18·94	7	4·41
·295	2	8·49	4	16·99	7	1·49
·300	2	7·55	4	15·11	6	22·66
·305	2	6 64	4	13·29	6	19·93
·310	2	5·76	4	11·52	6	17·29
·315	2	4 91	4	9 82	6	14·73
·320	2	4·08	4	8 16	6	12·25
·325	2	3 28	4	6·56	6	9·84
·330	2	2·50	4	5 01	6	7·51
·335	2	1·75	4	3·50	6	5·25
·340	2	1·00	4	2·03	6	3 06
·345	2	0 30	4	0·61	6	0·92
·350	1	23·61	3	23·23	5	22·85
·355	1	22·94	3	21·89	5	20·87
·360	1	22·29	3	20 59	5	18·88
·365	1	21·66	3	19·32	5	16·98
·370	1	21·04	3	18·09	5	15·13
·375	1	20·44	3	16·88	5	13 33
·380	1	19 86	3	15·71	5	11·58
·385	1	19·29	3	14·58	5	9·87
·390	1	18·73	3	13·47	5	8·20
·395	1	18·19	3	12·38	5	6·58
·400	1	17·66	3	11·33	5	5 00
·410	1	16 65	3	9·30	5	1·95
·420	1	15·68	3	7·36	4	23·05
·430	1	14·75	3	5·51	4	20 28
·440	1	13·87	3	3·75	4	17·63

Carding and Drawing Table.

	8 YARDS.			10 YARDS.		
Decl. of Hank.	Oz.	Dwts.	Grains.	Oz.	Dwts.	Grains.
·066	2	5	15·1	2	16	3·6
·067	2	5	0·0	2	15	8·7
·068	2	4	9·4	2	14	14·4
·069	2	3	19 1	2	13	20·7
·070	2	3	5·3	2	13	3·3
·071	2	2	15 9	2	12	10·7
·072	2	2	2·9	2	11	18·4
·073	2	1	14·2	2	11	2·5
·074	2	1	2 0	2	10	11·1
·075	2	0	13·8	2	9	0·1
·076	2	0	2 2	2	9	25·4
·077	1	17	20·3	2	8	15·2
·078	1	17	9 2	2	8	1·3
·079	1	16	22 3	2	7	11·8
·080	1	16	11 8	2	6	22·4
·081	1	16	1 5	2	6	9·8
·082	1	15	15 5	2	5	21·2
·083	1	15	5·7	2	5	9·0
·084	1	14	20 1	2	4	21·0
·085	1	14	10·8	2	4	9·3
·086	1	14	1·6	2	3	21·9
·087	1	13	16 7	2	3	10·8
·088	1	13	8 0	2	2	23·9
·089	1	12	23 5	2	2	13·3
·090	1	12	15·2	2	2	2·2
·091	1	12	7·1	2	1	16·7
·092	1	11	23·1	2	1	6·7
·093	1	11	15·3	2	0	21·0
·094	1	11	7·7	2	0	11·5
·095	1	11	0 2	2	0	2·1
·096	1	10	16·9	1	17	22.5
·097	1	10	9·7	1	17	13.6
·098	1	10	2·7	1	17	4.8
·099	1	9	19 9	1	16	20·2
·100	1	9	13·1	1	16	11·8
·102	1	9	0·0	1	15	19·4

Carding and Drawing Table.

8 YARDS.				10 YARDS.		
Decl. of Hank.	Oz.	Dwts.	Grains.	Oz.	Dwts.	Grains.
·104	1	8	11·5	1	15	3·7
·106	1	7	23·4	1	14	12·6
·108	1	7	11·7	1	13	22·1
110	1	7	0·5	1	13	8·0
·112	1	6	13·7	1	12	18·5
·114	1	6	3·2	1	12	5·4
116	1	5	17·2	1	11	16·8
·118	1	5	7·4	1	11	4·7
120	1	4	22·0	1	10	16·6
·122	1	4	12·9	1	10	5·5
·124	1	4	4·2	1	9	18·5
126	1	3	19·6	1	9	7·8
128	1	3	11 3	1	8	21·5
·130	1	3	3·3	1	8	11·5
132	1	2	19·5	1	8	1·8
·134	1	2	12·0	1	7	15·6
·136	1	2	4·6	1	7	7·2
138	1	1	21·5	1	6	22·3
140	1	1	14·6	1	6	13·7
·142	1	1	7·9	1	6	5·3
·144	1	1	0·7	1	5	21·2
·146	1	0	19·1	1	5	12·6
·148	1	0	12·9	1	5	6·0
·150	1	0	6·9	1	4	22·0
1525	..	18	5·1	1	4	12·9
1550	..	17	22·1	1	4	4·1
1575	..	17	15·2	1	3	19·6
·160	..	17	8·6	1	3	11·3
·165	..	16	20·0	1	2	19·5
170	..	16	8·1	1	2	4·5
175	..	15	20·9	1	1	14·6
180	..	15	10·0	1	1	1·4
·185	..	15	0·3	1	0	12·9
·190	..	14	14·8	1	0	1·1
·195	..	14	5·8	..	17	19·3
200	..	13	21·3	..	17	8·6

SLUBBING AND ROVING TABLE.

20 YARDS.			30 YARDS.		40 YARDS.		60 YARDS.	
Hank Roving.	Dwts.	Grains.	Dwts.	Grains	Dwts	Grains	Dwts.	Grains
1·00	6	22·6	10	10·0	13	21·3	22	14·5
1·05	6	14·7	9	22·0	13	5·4	21	14·7
1·10	6	7·5	9	11·2	12	15·0	20	17·0
1·15	6	0·9	9	1·3	12	1·8	18	2·7
1·20	5	18·8	8	16·3	11	13·7	17	8·6
1·25	5	13·3	8	8·0	11	2·6	16	16·0
1·30	5	8·2	8	0·3	10	16·4	16	0 6
1·35	5	3·4	7	17·1	10	6·9	15	10·3
1·40	4	23·0	7	10·5	9	22·0	14	21·1
1·45	4	18·9	7	4·4	9	13·8	14	8·8
1·50	4	15·1	6	22·6	9	6·2	13	21·3
1·55	4	11·5	6	17·2	8	23·0	13	10·5
1·60	4	8·1	6	12·2	8	16·3	13	0·5
1·65	4	5·1	6	7·6	8	10·2	12	15·0
1·70	4	2·0	6	3 0	8	4·0	12	06·1
1·75	3	23·9	5	22·8	7	22·4	11	21·7
1·80	3	20·6	5	18 8	7	17·1	11	13·7
1 85	3	18·0	5	15·1	7	12·1	11	6·2
1·90	3	15·7	5	11·5	7	7·4	10	23·1
1·95	3	13·4	5	8·2	7	2·9	10	16·4
2·00	3	11·3	5	5·0	6	22·6	10	10·0
2·05	3	9·3	5	1·9	6	18·6	10	3·8
2·10	3	7·3	4	23·0	6	14·7	9	22·0
2·15	3	5·5	4	20·2	6	11·0	9	16·4
2·20	3	3·7	4	17·6	6	7·3	9	11·3
2·25	3	2·0	4	15·1	6	4·1	9	6·2
2·30	3	0·4	4	12·6	6	0·9	9	1·3
2·35	2	22 9	4	10·3	5	21·8	8	10·6
2·40	2	21·4	4	8·1	5	18·8	8	16·2
2·45	2	20·0	4	6·0	5	16·0	8	12·0
2·50	2	18·6	4	4·0	5	13·3	8	8·0
2·55	2	17·3	4	2·0	5	10·7	8	4·0
2·60	2	16·1	4	0·1	5	8·2	8	0·3
2·65	2	14·9	3	22·3	5	5·7	7	20·6
2·70	2	13·7	3	20·6	5	3·4	7	17·2
2·75	2	12·6	3	18·9	5	1·2	7	13·8

Slubbing and Roving Table.

20 YARDS.			30 YARDS.		40 YARDS.		60 YARDS.	
Hank Roving.	Dwts.	Grains.	Dwts.	Grains.	Dwts.	Grains.	Dwts.	Grains
2·80	2	11·5	3	17·2	4	23·0	7	10·5
2·85	2	10·4	3	15·7	4	20·9	7	7·4
2·90	2	9·4	3	14·2	4	18·9	7	4·4
2·95	2	8·5	3	12·7	4	17·0	7	1·5
3·00	2	7·5	3	11·3	4	15·1	6	22·6
3·05	2	6·6	3	9·9	4	13·2	6	19·9
3·10	2	5·7	3	8·6	4	11·5	6	16·3
3·15	2	4·0	3	7·3	4	9·8	6	14·7
3·20	2	4·0	3	6·1	4	8·1	6	12·2
3·25	2	3·2	3	4·9	4	6·5	6	9·8
3·30	2	2·5	3	3·7	4	5·0	6	7·5
3·35	2	1·7	3	2·6	4	3·5	6	5·2
3·40	2	1·0	3	1·5	4	2·0	6	3·0
3·45	2	0·3	3	0·4	4	0·6	6	0·9
3·50	1	23·6	2	23·4	3	22·2	5	22·8
3·55	1	22·9	2	22·4	3	21·9	5	20·8
3·60	1	22·3	2	21·4	3	20·6	5	18·8
3·65	1	21·6	2	20·5	3	19·3	5	16·9
3·70	1	21·0	2	19·5	3	18·1	5	15·1
3·75	1	20·4	2	18·6	3	16·8	5	13·3
3·80	1	19·8	2	17·7	3	15·7	5	11·5
3·85	1	19·2	2	16·9	3	14·5	5	9·9
3·90	1	18·7	2	16·1	3	13·4	5	8·2
3·95	1	18·1	2	15·3	3	12·4	5	6·6
4·00	1	17·6	2	14·5	3	11·3	5	5·0
4·10	1	16·6	2	12·9	3	9·3	5	1·9
4·20	1	15·7	2	11·5	3	7·3	4	23·0
4·30	1	14·7	2	10·1	3	5·5	4	20·2
4·40	1	13·8	2	8 8	3	3·7	4	17·6
4·50	1	13·0	2	7·5	3	2·0	4	15·1
4·60	1	12·2	2	6·3	3	0·4	4	12·7
4·70	1	11·4	2	5·2	2	22·9	4	10·4
4·80	1	10·7	2	4·1	2	21·4	4	8·1
4·90	1	10·0	2	3·0	2	20·0	4	6·0
5·00	1	9·3	2	2·0	2	18·6	4	4·0
5·25	1	7·6	1	23·6	2	15·2	3	23·2

Slubbing and Roving Table.

20 YARDS.			30 YARDS.		40 YARDS.		60 YARDS.	
Hank Roving.	Dwts.	Grains.	Dwts.	Grains	Dwts.	Grains.	Dwts.	Grains.
5·50	1	6·3	1	21·4	2	12·6	3	18·9
5·75	1	4·9	1	19·5	2	9·9	3	15·0
6·00	1	3 7	1	17·6	2	7·5	3	11·3
6·25	1	2·6	1	16 0	2	5·3	3	8·0
6·50	1	1·6	1	14·4	2	3 2	3	4·9
6·75	1	0·6	1	13·0	2	1·3	3	2 0
7·00	0	23·8	1	11·7	1	23·6	2	23·4
7·25	0	22·9	1	10·4	1	21·9	2	20·9

30 YARDS.			40 YARDS.		60 YARDS.		120 YARDS.	
Hank Roving.	Dwts.	Grains.	Dwts.	Grains.	Dwts	Grains.	Dwts.	Grains.
7·50	1	9·3	1	20·4	2	18 6	5	13·3
7·75	1	8 2	1	19·0	2	16 5	5	9·0
8·00	1	7·2	1	17 6	2	14·5	5	5·0
8 25	1	6·3	1	16 4	2	12 6	5	1·2
8·50	1	5·4	1	15 2	2	10·8	4	21·6
8·75	1	4·5	1	14·1	2	9·1	4	18 2
9·00	1	3 7	1	13·0	2	7·5	4	15·1
9·25	1	3·0	1	12·0	2	6·0	4	12·0
9·50	1	2·3	1	11·1	2	4·6	4	9 2
9·75	1	1·6	1	10·1	2	3·2	4	6·4
10 00	1	1·0	1	9·33	2	2·0	4	4·0
10·25	1	0·39	1	8 52	2	0·78	4	1·56
10·50	..	23·81	1	7·73	1	23·62	3	23·23
10·75	..	23·26	1	7 00	1	22·52	3	21·04
11·00	..	22·72	1	6·30	1	22·15	3	18 90
11·25	..	22·22	1	5·62	1	20·44	3	16·88
11·50	..	21·73	1	4·98	1	19 47	3	14·95
11·75	..	21·27	1	4·33	1	18·55	3	13·10
12·00	..	20·83	1	3·77	1	17·66	3	11 33
12·25	..	20·42	1	3·20	1	16·81	3	9·60
12·50	..	20·09	1	2·66	1	16·00	3	8·00
12·75	..	19 60	1	2·14	1	15 21	3	6·43
13·00	..	19·23	1	1·64	1	14·46	3	4·92

Slubbing and Roving Table.

30 YARDS.			40 YARDS.		60 YARDS.		120 YARDS.	
Hank Roving.	Dwts.	Grains.	Dwts.	Grains.	Dwts.	Grains.	Dwts.	Grains.
13·25	..	18·86	1	1·16	1	13·73	3	3·47
13·50	..	18·51	1	0·69	1	13·03	3	2·07
13·75	..	18·18	1	0·24	1	12·36	3	0·72
14·00	..	17·85	..	23·80	1	11·71	2	23·42
14 25	..	17·54	..	23·39	1	11·08	2	22 17
14 50	..	17·24	..	22·98	1	10·48	2	20·96
14·75	..	18·94	..	22 89	1	9·89	2	19·79
15·00	..	16·66	..	22·22	1	9·33	2	18 66
15·25	..	16 39	..	21·85	1	8·78	2	17·57
15·50	..	16·12	..	21·52	1	8·25	2	16·57
15·75	..	15·87	..	21·16	1	7·74	2	15·49
16·00	..	15·62	..	20·83	1	7·25	2	14·50
16·50	..	15·15	..	20·20	1	6·30	2	12·60
17·00	..	14·70	..	19·66	1	5·41	2	10·82
17·50	..	14·28	..	19·05	1	4·57	2	9·14
18·00	..	13·88	..	18·51	1	3·77	2	7·55
18·50	..	13·51	..	18·01	1	3·02	2	6·05

GRAMMES PER METRE INTO DWTS. PER YARD.

Grammes.	Dwts.	Grammes.	Dwts.	Grammes.	Dwts.	Grammes.	Dwts
1	0·58785	9	5·29065	17	9·99345	70	41 1495
2	1·17570	10	5·87850	18	10·58130	80	47·0280
3	1·76355	11	6·46635	19	11·16915	90	52·9065
4	2·35140	12	7·05420	20	11·75700	100	58·7850
5	2·93925	13	7·64205	30	17·63550	200	117·5700
6	3·52710	14	8·22990	40	23·51400	300	176·3550
7	4·11495	15	8·81773	50	29·39250	400	235·1400
8	4 70280	16	9·40560	60	35·27100	500	293·9250
						1000	587 8500

DWTS. PER YARD INTO GRAMMES PER METRE.

Dwts.	Grammes.	Dwts.	Grammes	Dwts.	Grammes	Dwts.	Grammes
1	1·7	9	15·3	17	28·9	70	119
2	3·4	10	17·0	18	30·6	80	136
3	5·1	11	18 7	19	32·3	90	153
4	6 8	12	20·4	20	34·0	100	170
5	8·5	13	22·1	30	51·0	200	340
6	10·2	14	23·8	40	68·0	300	510
7	11·9	15	25 5	50	85·0	400	680
8	13 6	16	27·2	60	102·0	500	850
						1,000	1,700

ENGLISH MEASURES AND WEIGHTS REDUCED TO FRENCH.

TROY WEIGHT.

Grain	=	0,0648 grammes.
Pennyweight (24 grs)	=	1,555 „
Ounce (20 dwts)	=	31,103 „
Pounds (12 oz)	=	0,373 kilogramme.
175 lbs troy	=	144 lbs. avoirdupois
Lbs avoirdupois × 1-2153.. .	=	lbs troy or apothecary
Lbs. troy or apoth × 0·82280	=	avoirdupois.

AVOIRDUPOIS WEIGHT.

Drachm (dr.m)	=	1,771 grammes.
Ounce (16 dr.)	=	28,349 „
Pound (16 oz.)	=	0,453 kilogramme.
Quarter (28 lbs)	=	12,700 „
Hundredweight (112 lbs)	=	50,802 „
Ton (20 cwts.)	=	1016,048 „

MEASURE OF CAPACITY.

Pint	=	0,5679 litres.
Quart (2 pints)	=	1,135 „
Gallon (4 quarts)	=	4,543 „
Peck (2 gallons)	=	9,087 „
Bushel (4 pecks)	=	36,347 „
Quarter (8 bushels)	=	290,781 „
Load (5 quarters)	=	1453,907 „

LONG MEASURE

Inch	=	0,0254 metres.
Foot (12 inches)	=	0,3048 „
Yard (3 ft.)	=	0,9144 „
Fathom (2 yds)	=	1,8288 „
Pole (5½ yards)	=	5,0291 „
Furlong (220 yds.)	=	201,16 „
Mile (1760 yards)	=	1609,315 „ or 1,609 kilometres.

SUPERFICIAL MEASURE

Square inch	=	0,000645 square metres.
„ foot (144 sq. ins.)	=	0,0929 „ „
„ yard (9 sq ft)	=	0,8361 „ „
Perch (30¼ sq. yds.)	=	25,292 „ „
Rood (1210 sq yds)	=	1011 „ „
Acre (4840 sq. yds.)	=	4046 „ „

SOLID MEASURE.

Cubic inch	=	0,000016386 cubic metres.
„ foot (1728 cubic ins.)	=	0,028315 „
„ yard (27 cubic ft.)	=	0,764513 „

FRENCH MEASURES AND WEIGHTS REDUCED TO ENGLISH.

LONG MEASURE.

Millimetre ($\frac{1}{1000}$m.)	=	0·039 inches.
Centimetre ($\frac{1}{100}$m.)	=	0·393 ,,
Decimetre ($\frac{1}{10}$m.)	=	3·937 ,,
Metre (m)	=	3 28089 feet (39·3704 inches).
Decametre (10m.).....	=	32·8089 feet.
Kilometre (1000m)	=	1093·633 yards.
Myriametre (10000m.)..	=	6·213 miles.

MEASURE OF CAPACITY.

Litre (1 cubic decimetre)	=	1·761 pint.
Decalitre (10 litres)	=	2·2 gallons.
Hectolitre (100 litres) ..	=	22·009 gallons or 2·751 bushels.
Kilolitre, metre cube (1000 litres)	=	3·426 quarters.
Decilitre ($\frac{1}{10}$ litre).....	=	0·176 pint.
Centilitre ($\frac{1}{100}$ litre)	=	0·017 ,,

SUPERFICIAL MEASURE.

Are (100 sq. metres)....	=	0 988 rood.
Hectare (10000 sq metres)	=	2·4736 acres.
Centaire (1 sq metre) ..	=	1·196 sq. yard.

WEIGHTS.

Gramme	=	15·432 grains troy.
Decagramme (10 grms.) .	=	6·43 dwts.
Hectogramme (100 grms.)	=	3·527 oz. avoir. or 3·216 oz. troy.
Kilogramme (1000 grms.)	=	2 205 lbs. avoir. or 2·68 lbs. troy.
Quintel métrique (100 kilos)....	=	220·5 lbs.
Millier (1000 kilos.)	=	19 cwts. 12 oz. 5 dwts.
Decigramme ($\frac{1}{10}$ grm.) ..	=	1 543 grain.
Centigramme ($\frac{1}{100}$ grm.).	=	0·154 ,,
Milligramme ($\frac{1}{1000}$ grm.)	=	0·0154 ,,

THERMOMETER.

0°	Centigrade	(freezing point of water)..	=	32° Fahrenheit.
100°	,,	(boiling point of water)..	=	212° ,,
0°	Réaumur	(freezing point of water)..	=	32° ,,
80°	,,	(boiling point of water)..	=	212° ,,

DECIMAL EQUIVALENTS OF FRACTIONS OF AN INCH.

1/32	0·03125	9/32	0 28125	17/32	0 53125	25/32	0·78125
1/16	0·0625	5/16	0·3125	9/16	0 5625	13/16	0·8125
3/32	0·09375	11/32	0 34375	19/32	0·59375	27/32	0·84375
1/8	0·125	3/8	0·375	5/8	0 625	7/8	0·875
5/32	0 15625	13/32	0 40625	21/32	0·65625	29/32	0 90625
3/16	0·1875	7/16	0 4375	11/16	0 6875	15/16	0·9375
7/32	0·21875	15/32	0·46875	23/32	0 71875	31/32	0 96875
1/4	0·25	1/2	0·5	3/4	0·75	1	1 0

CIRCUMFERENCES OF CIRCLES, ADVANCING BY 8ths.

Diameter.	Circumferences							
	0	1/8	1/4	3/8	1/2	5/8	3/4	7/8
0		0·3927	0 7854	1·178	1 570	1 963	2·356	2 748
1	3·141	3·534	3·927	4·319	4·712	5 105	5·497	5 890
2	6 283	6 675	7 068	7 461	7·854	8·246	8·639	9 032
3	9·424	9 817	10·21	10·60	10·99	11 38	11·78	12 17
4	12·56	12·95	13·35	13·74	14·13	14·52	14·92	15·31
5	15·70	16 10	16 49	16·88	17·27	17·67	18 06	18·45
6	18 84	19 24	19 63	20·02	20·42	20·81	21·20	21·59
7	21 99	22·38	22 77	23 16	23·56	23·95	24·34	24 74
8	25·13	25 52	25·91	26·31	26·70	27·09	27·48	27 88
9	28·27	28·66	29·05	29·45	29·84	30·23	30·63	31·02
10	31·41	31 80	32 20	32·59	32·98	33·37	33·77	34 16

Diameter of a circle × 3·1416 = the circumference.

FEET AND INCHES AND EQUIVALENTS IN METRES.

Ft. in	Metres	Ft. in.	Metres	Ft in.	Metres	Ft. in.	Metres.
0 0½	0 013	4 0	1 219	30 0	9·143	56 0	17·067
0 1	0·025	5 0	1·523	31 0	9 447	57 0	17 372
0 1½	0·038	6 0	1·828	32 0	9·752	58 0	17 677
0 2	0 051	7 0	2·132	33 0	10·057	59 0	17·982
0 2½	0·063	8 0	2·437	34 0	10 362	60 0	18·287
0 3	0·076	9 0	2·741	35 0	10 667	61 0	18·592
0 3½	0 089	10 0	3 047	36 0	10 972	62 0	18·896
0 4	0·101	11 0	3·352	37 0	11 276	63 0	19·201
0 4½	0·114	12 0	3·656	38 0	11·581	64 0	19·506
0 5	0·127	13 0	3·961	39 0	11 886	65 0	19·811
0 5½	0·140	14 0	4·266	40 0	12·191	66 0	20·115
0 6	0·152	15 0	4·571	41 0	12·495	67 0	20·420
0 6½	0·165	16 0	4·875	42 0	12·800	68 0	20 725
0 7	0·178	17 0	5·180	43 0	13·105	69 0	21·030
0 7½	0 190	18 0	5 485	44 0	13·410	70 0	21·335
0 8	0·203	19 0	5·790	45 0	13·715	71 0	21·639
0 8½	0·216	20 0	6 095	46 0	14 019	72 0	21·944
0 9	0 228	21 0	6·400	47 0	14 324	73 0	22·249
0 9½	0·241	22 0	6·705	48 0	14·629	74 0	22·554
0 10	0·254	23 0	7·010	49 0	14·934	75 0	22·859
0 10½	0·267	24 0	7 315	50 0	15·239	76 0	23 164
0 11	0·279	25 0	7·620	51 0	15·543	77 0	23·469
0 11½	0·292	26 0	7·924	52 0	15 848	78 0	23·774
1 0	0·305	27 0	8·229	53 0	16·153	79 0	24·079
2 0	0·606	28 0	8 534	54 0	16·458	80 0	24·383
3 0	0·914	29 0	8 838	55 0	16 763	81 0	24·688

NOTE.

Feet × 0,3048 = metres.

Inches × 25,399 = millimetres.

MILLIMETRES AND EQUIVALENTS IN INCHES.

Millimetres	Inches		Millimetres	Inches		Millimetres	Inches		Millimetres	Inches	
1	0 0394	1/64 −	26	1 0236	1 1/32	51	2 0079	2 1/64 −	76	2 9922	2 63/64 +
2	0 0787	5/64	27	1 0630	1 1/16	52	2 0473	2 1/32 +	77	3 0315	3 1/32
3	0 1181	1/8 —	28	1 1024	1 7/64 —	53	2 0866	2 7/64 —	78	3 0709	3 5/64 —
4	0 1575	5/32 +	29	1 1417	1 9/64 +	54	2 1260	2 1/8 +	79	3 1103	3 7/64 +
5	0 1968	13/64 —	30	1 1811	1 11/64 —	55	2 1654	2 11/64 —	80	3 1496	3 5/32 —
6	0 2362	15/64 +	31	1 2205	1 7/32 +	56	2 2047	2 9/32 +	81	3 1890	3 11/64 +
7	0 2756	9/32 —	32	1 2598	1 13/64 —	57	2 2441	2 1/4 —	82	3 2284	3 13/64 —
8	0 3150	5/16 +	33	1 2992	1 19/64 +	58	2 2835	2 5/32 +	83	3 2677	3 7/32 +
9	0 3543	23/64 —	34	1 3386	1 21/64	59	2 3228	2 21/64 −	84	3 3071	3 5/16 —
10	0 3937	25/64 +	35	1 3780	1 3/8 +	60	2 3622	2 23/64 +	85	3 3465	3 21/64 +
11	0 4331	7/16 —	36	1 4173	1 7/16 —	61	2 4016	2 25/64 —	86	3 3859	3 23/64 —
12	0 4724	15/32 +	37	1 4567	1 29/64 +	62	2 4410	2 7/16 +	87	3 4252	3 27/64 +
13	0 5118	33/64 —	38	1 4961	1 1/2 —	63	2 4803	2 31/64	88	3 4646	3 29/64 —
14	0 5512	35/64 +	39	1 5354	1 33/64 +	64	2 5197	2 33/64 +	89	3 5040	3 1/2 +
15	0 5906	19/32 —	40	1 5748	1 37/64 —	65	2 5591	2 17/32 —	90	3 5433	3 35/64 —
16	0 6299	1/8 +	41	1 6142	1 41/64 +	66	2 5984	2 19/32 +	91	3 5827	3 37/64 +
17	0 6693	43/64 —	42	1 6536	1 21/32 —	67	2 6378	2 41/64	92	3 6221	3 39/64 —
18	0 7087	45/64 +	43	1 6929	1 45/64 +	68	2 6772	2 43/64 +	93	3 6614	3 43/64 +
19	0 7480	3/4 —	44	1 7323	1 47/64 —	69	2 7166	2 23/32 —	94	3 7008	3 23/32 —
20	0 7874	25/32 +	45	1 7717	1 49/64 +	70	2 7559	2 49/64 +	95	3 7402	3 47/64 +
21	0 8268	53/64 —	46	1 8110	1 51/64 —	71	2 7953	2 51/64 —	96	3 7796	3 49/64 —
22	0 8661	55/64 +	47	1 8504	1 27/32 +	72	2 8347	2 53/64 +	97	3 8189	3 51/64 +
23	0 9055	57/64 —	48	1 8898	1 57/64	73	2 8740	2 7/8	98	3 8583	3 55/64 —
24	0 9449	15/16 +	49	1 9291	1 59/64 +	74	2 9134	2 59/64 +	99	3 8977	3 57/64 +
25	0 9843	63/64	50	1 9685	1 61/64	75	2 9528	2 61/64	100	3 9370	3 15/16

NOTE.

The plus sign (+) means full measure
The minus sign (−) means bare measure.
Millimetres × 0·03937 = inches
Metres × 39 37 = inches
Metres × 3 281 = feet

CONVENIENT MULTIPLIERS.

Circles, Areas and Figures.

Diameter of a circle × 3 1416 or $\frac{22}{7}$ = the circumference
Circumference of a circle × 0 31831 or $\frac{7}{22}$ the diameter
Square of diameter × 0 7854 = the area of the circle
Square of diameter × $\frac{11}{14}$ = the area of the circle
Square root of area × 1 12837 the diameter of a circle
Radius of circle × 6 28318 = the circumference
Circumference = 3 5449 × $\sqrt{}$ area of circle
Diameter of a circle × 0 8862 the side of an equal square
Side of a square × 1 128 the diameter of an equal circle
Area of a triangle = the base × ½ the perpendicular height
Square of the diameter of a sphere × 3 1416 = the convex surface
Cube of the diameter of a sphere × 0 5236 the solidity
Diameter of a sphere × 0 806 the edge of an equal cube
Diameter of a sphere × 0 6667 the length of an equal cylinder
Surface of a cylinder area of both ends + length × circumference.
Solidity of a cylinder area of one end × the length
Solidity of a cone area of the base × ⅓ the perpendicular height
Area of an ellipse long axis × short axis × 0 7854

Conversion of one Denomination to another.

Feet × 0 00019 = miles
Yards × 0 0006 miles
Square inches × 0 00694 square feet
Square feet × 144 = square inches
Cubic feet × 0 037 = cubic yards
Cubic inches × 0 000579 = cubic feet
Cubic feet × 6 2355 = gallons
Gallons × 0 16059 cubic feet
Gallons × 10 = lbs of distilled water
Cubic feet of water × 62 425 = lbs avoirdupois
Cubic inches of water × 0 03612 = lbs avoirdupois
Lbs avoirdupois × 1 2153 = lbs troy or apothecary
Lbs troy or apothecary × 0 8228 = lbs avoirdupois
Lbs avoirdupois × 0 00893 = cwts
Lbs avoirdupois × 0 000447 = tons
Tons of water × 224 = gallons

CONVERSION OF THE METRIC AND ENGLISH SYSTEMS.

Measures.

Metres × 1 094	yards
Metres × 3 281	feet
Metres × 39 37	inches
Yards × 0 9144	metres
Feet × 0 3048 =	metres
Inches × 0 0254	metres
Miles × 1 6093	kilometres
Kilometres 0 6213	miles
Millimetres × 0 03937	inches
Inches × 25 399 =	millimetres
Square metres × 1 196	square yards
Square yards 0 8361	square metres
Kilogrammes per metre × 0 672	lbs per foot
Kilogramme per cubic metre × 0 026	lbs per cubic foot
Hectolitres × 3 531	cubic feet
Hectolitres × 0 31	cubic yards

Capacity

Gallons × 4 543	litres
Litres × 0 22	gallons
Quarts 1 1 6	litres
Pints × 0 67	litres
Litres × 1 76	pints
Litres × 0 035	cubic feet
Cubic feet × 28 35	litre
Litres × 61 02	cubic inches (Act of Congress)
Litres × 33 81	fluid ounces

Weight.

Grains troy × 0 0648	grammes
Dwts troy × 1 555	gramme
Ounce avoirdupois × 28 3495	grammes
Lbs × 453 59	grammes
Lbs × 0 4535	kilogrammes
Lbs produced in 56 hours × 0 177	lbs produced in 10 hours
Lbs produced in 56 hours × 0 08	kilogramme produced in 10 hours
Grammes × 15 432	grains troy
Grammes × 0 643	dwts troy
Grammes × 0 3527	ounces avoirdupois
Grammes × 0 0022	lbs
Kilogrammes × 2 2046 =	lbs
Kilogrammes × 35 3	ounces avoirdupois
Kilogrammes per lineal metre × 2 016	lbs per lineal yard

Miscellaneous.

French Counts of Yarn × 1 18	English Counts	
English Counts of Yarn × 0 847 =	French Counts of Yarn	
Mule Twist for Indian and American Cotton	square root of counts ×	3 75
Weft	"	× 3 25
Ring Frame Twist	"	× 4 00
Mule Twist for Egyptian Cotton	"	× 3 606
" Weft	"	× 3 183
Ring Frame Twist	"	× 4 606
" Doubling Twist	"	× 4 5

Degrees Centigrade × 1 8 + 32 Degrees Fahrenheit
Degree Fahrenheit × 0 555 − 32 Degrees Centigrade

Conversion of the Metric and English Systems.

Power.

Foot lbs. × 0·13825 = Kilogrammetres (units of work, French)
Kilogrammetres × 7·233 = foot lbs. (units of work).
Horse power × 0.9863 = force de cheval (French horse power).
Force de cheval × 1·01385 = horse power.
Lbs. per square foot × 4 882 = kilogrammes per square metre.
Kilogrammes per square metre × 0 2048 = lbs. per square foot.
Lbs per square inch × 0 0703 = kilogrammes per square centimetre.
Kilogrammes per square centimetre × 14 223 = lbs per square inch.
Foot lbs. (units of work) × 0 000303 = horse power.
Horse power × 33000 = foot lbs or units of work.

ROPE DRIVING.

Tables of the Horse Power of Transmission Rope, by C. W. HUNT. The working strain is 800 lbs for a 2-inch diameter rope and is the same at all speeds, due allowance having been made for loss by centrifugal force

Diam Rope Inches.	Speed of the Rope in Feet per Minute.										Smallest Diam Pulleys Inches.
	1500	2000	2500	3000	3500	4000	4500	5000	6000	7000	
¾	3·3	4 3	5·2	5·8	6 7	7 2	7 7	7 7	7·1	4·9	30
⅞	4 5	5 9	7·0	8 2	9 1	9 8	10·8	10 8	9 3	6 5	36
1	5 8	7·7	9 2	10 7	11 9	12·8	13 6	13·7	12·5	8·8	42
1¼	9 2	12 1	14·3	16 8	18 6	20 0	21 2	21 4	19 5	13·8	54
1½	13·1	17·4	20 7	23·1	26·8	28 8	30·6	30·8	28·2	19 8	60
1¾	18 0	23·7	28 2	32 8	36 4	39 2	41 5	41 8	37 4	27 6	72
2	23 1	30·8	36 8	42·8	47 6	51·2	54·4	54·8	50·0	35·2	84

Weight.

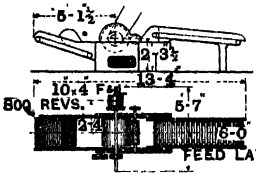
Weight of Cast Iron = cubic inches × 0 26·
Weight of Wrought Iron = „ × 0·28.
Weight of Steel = „ × 0·288.
Weight of Brass = „ × 0·3.
Weight of Lead = „ × 0 41.
Weight of Copper = „ × 0·32.
Weight of Wrought Iron × 0·93 = Weight of Cast Iron.
Weight of Wrought Iron × 1·02 = Weight of Steel

PLANS

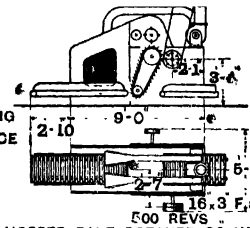
OF

COTTON MILLS,

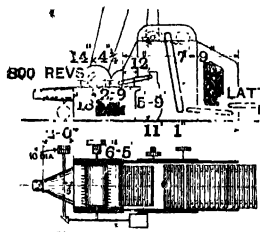
ETC.



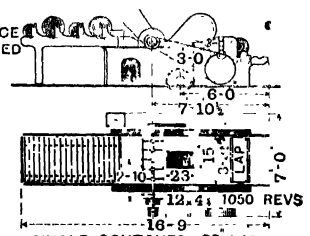
ROVING WASTE OPENER.



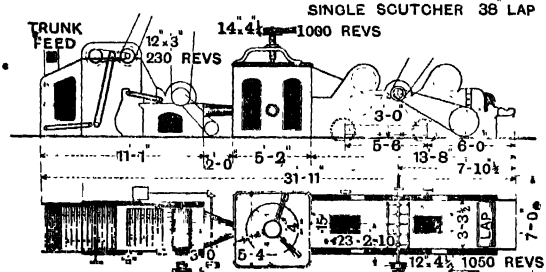
HOPPER BALE BREAKER. 36 WIDE



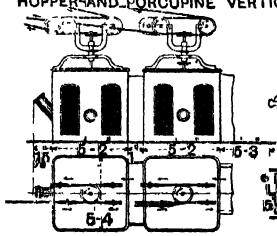
HOPPER FEEDER AND PORCUPINE OPENER.



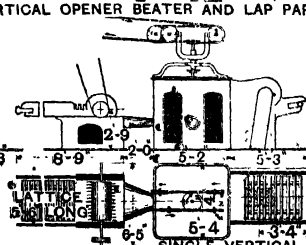
SINGLE SCUTCHER 38" LAP



HOPPER AND PORCUPINE VERTICAL OPENER BEATER AND LAP PART

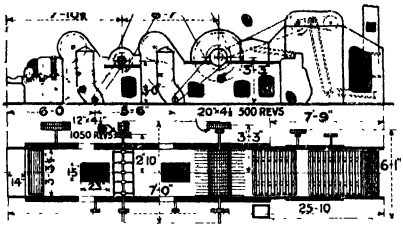


DOUBLE VERTICAL OPENER.

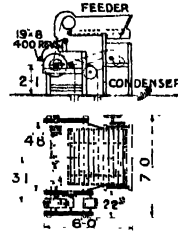


PORCUPINE

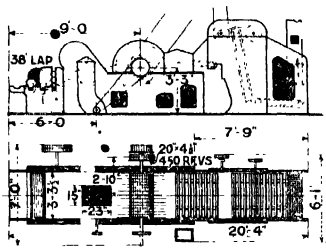
SINGLE VERTICAL OPENER



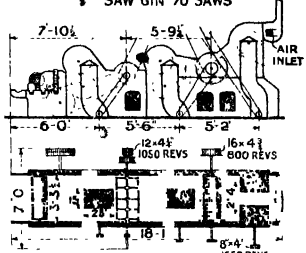
DOUBLE OPENER WITH HOPPER FEEDER 38" LAPS



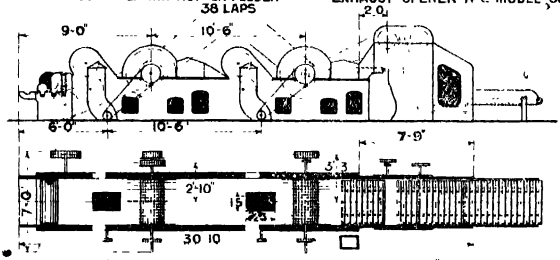
SAW GIN 70 SAWS



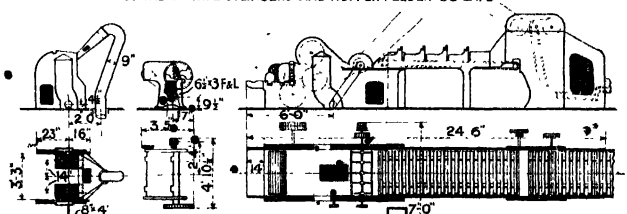
SINGLE OPENER WITH HOPPER FEEDER 38 LAPS



EXHAUST OPENER N°2 MODEL 38 LAPS



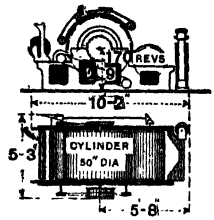
OPENER WITH 2 CYLINDERS AND HOPPER FEEDER 38" LAPS



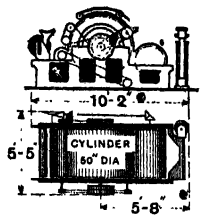
EXHAUST FEED MACHINE

MACARTHY GIN

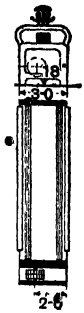
SINGLE SCUTCHER WITH HOPPER FEEDER FOR DOUBLING LAPS



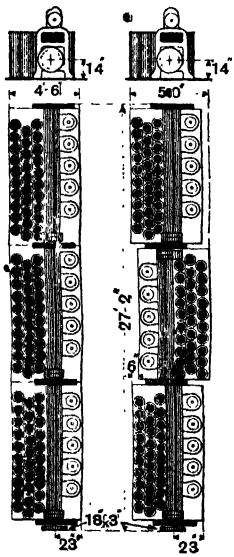
REVOLVING FLAT CARD
38" ON WIRE
PULLEYS 18"x3" FAST AND LOOSE



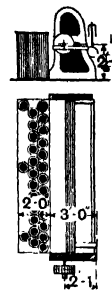
MIXED CARD
38" ON WIRE



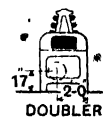
RING SPINNING OR DOUBLING FRAME



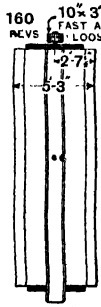
DRAWING FRAME
16" ROLLER



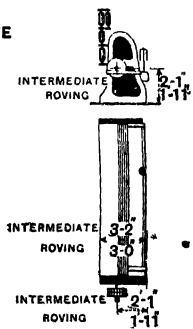
SLUBBING FRAME



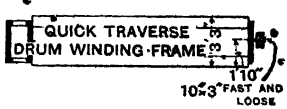
DOUBLER

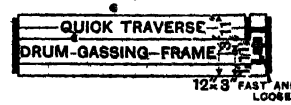


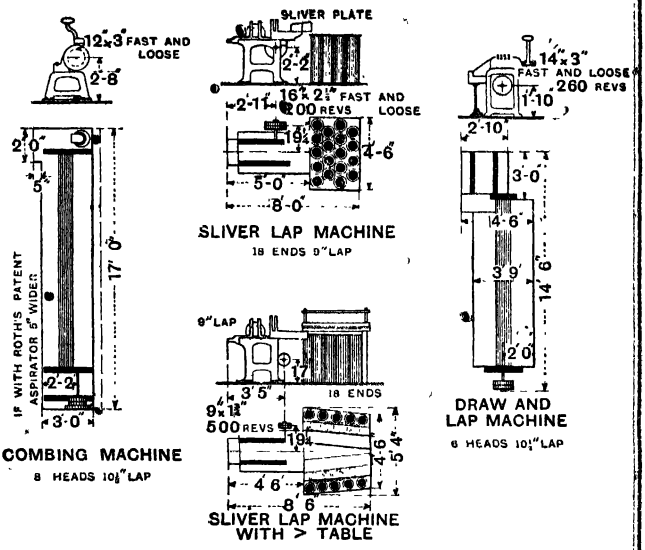
UPRIGHT SPINDLE WINDING FRAME

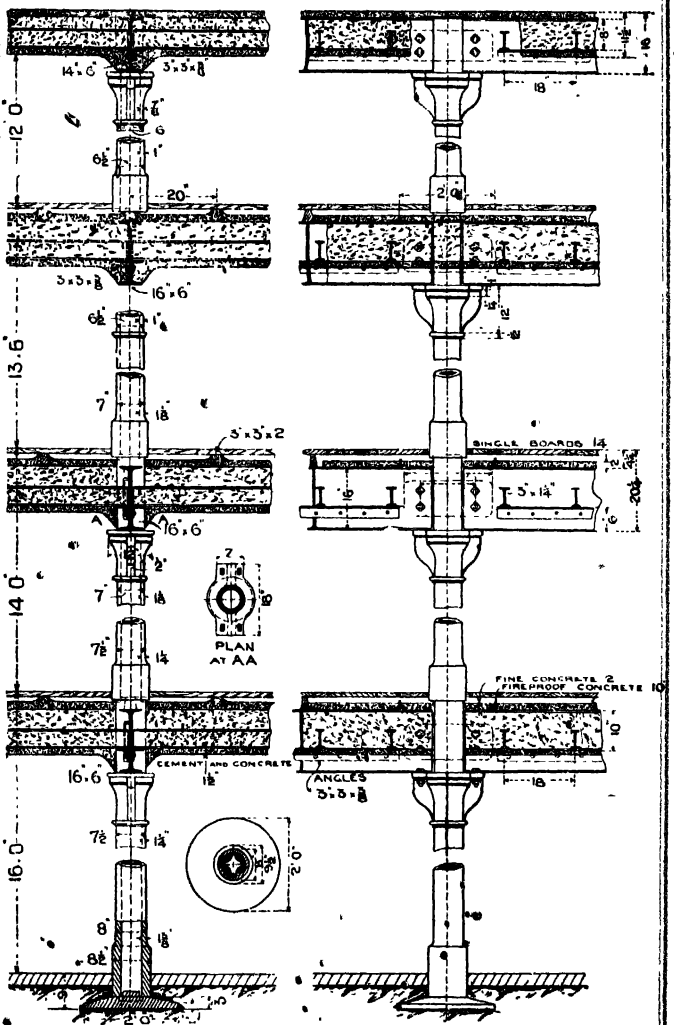


INTERMEDIATE OR ROVING FRAME

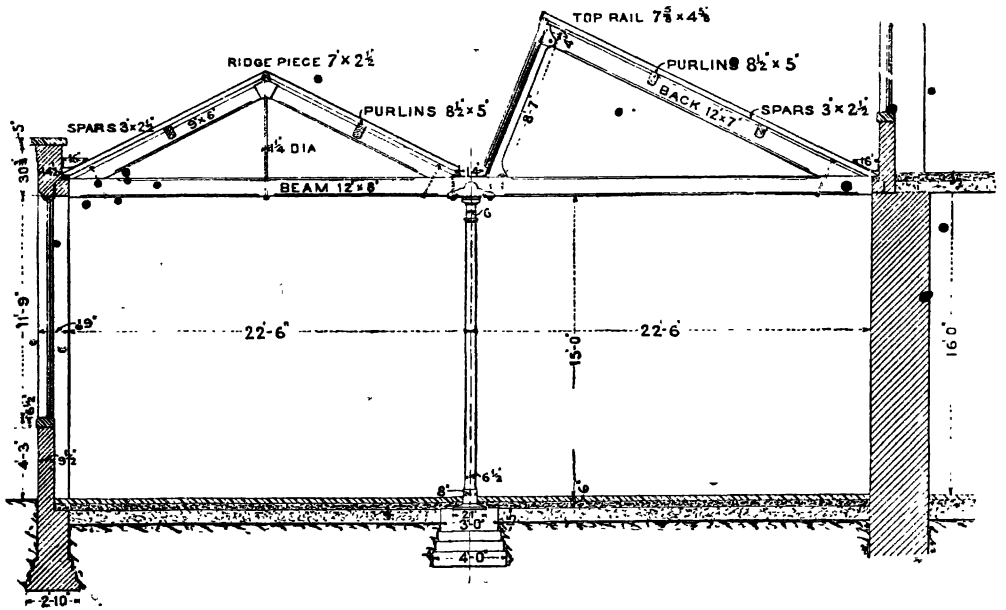




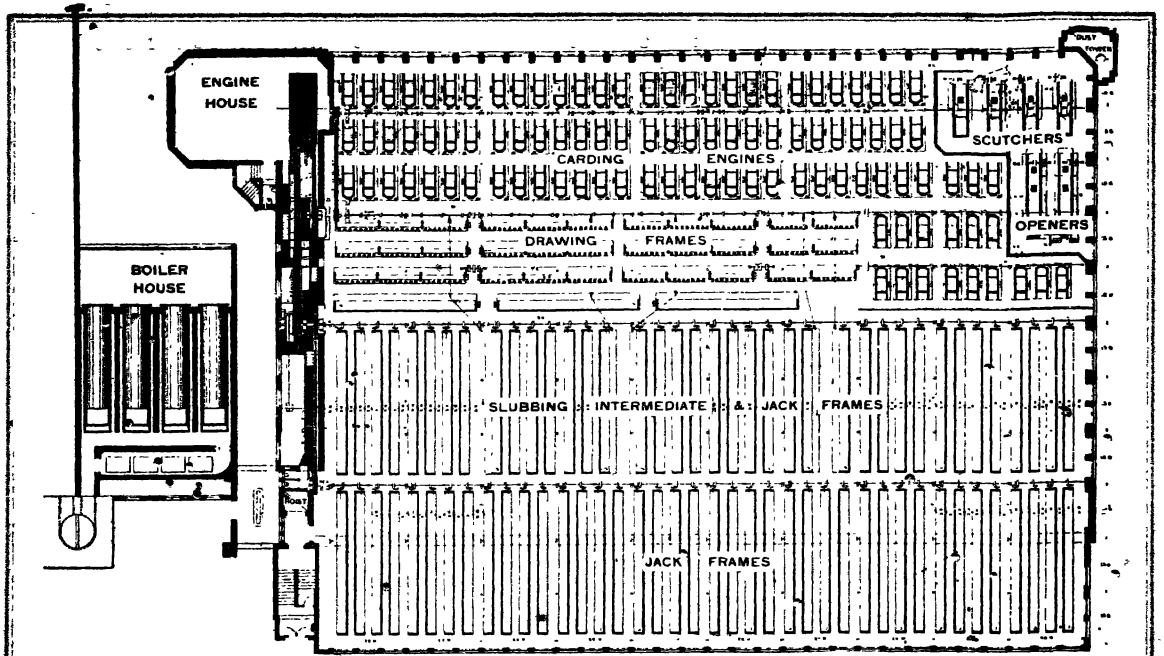

12"x3" FAST AND LOOSE
2-8
SLIVER PLATE
2-2
16"x2½" FAST AND LOOSE 200 REVS
2-11
19½
4-6
5-0
8-0
SLIVER LAP MACHINE
18 ENDS 9"LAP
14"x3" FAST AND LOOSE 260 REVS
1-10
2-10
3-0
4-6
3-9
14-6
2-0
DRAW AND LAP MACHINE
6 HEADS 10½"LAP
2-0
5½
17-0
IF WITH ROTH'S PATENT ASPIRATOR 5" WIDER
2-2
3-0
COMBING MACHINE
8 HEADS 10½"LAP
9"LAP
17
3-5
18 ENDS
9"x1½" 500 REVS
19¼
4-6
5-4
4-6
8-6
SLIVER LAP MACHINE WITH > TABLE
SINGLE BOBBIN REEL 40 HANK
12-6
SINGLE HAND REEL 40 HANK
3½" GAUGE
7"x1½" FAST AND LOOSE 125 REVS
IMPROVED REEL 80 HANK-13-4
3½" GAUGE
8"x1½" FAST AND LOOSE 250 REVS
16"x3" FAST AND LOOSE 60 REVS
20"
4-0
2-6
BUNDLING PRESS
DOUBLE BOBBIN REEL 40-HANK 13-0
3½" GAUGE
7"x1½" FAST AND LOOSE 150 REVS
6"x1½" FAST AND LOOSE 350 REVS
3-8"
2-9
BANDING MACHINE 10 SPINDLE
12"x2½" FAST AND LOOSE 80 REVS
3-0
3-0
BALLING MACHINE
20
20
HAND BALLING MACHINE



SECTION OF A 4-STOREY MILL.



SECTION OF SHED MILL SHEWING TWO TYPES OF ROOFS; ALSO TO JOIN TO STOREY MILL.

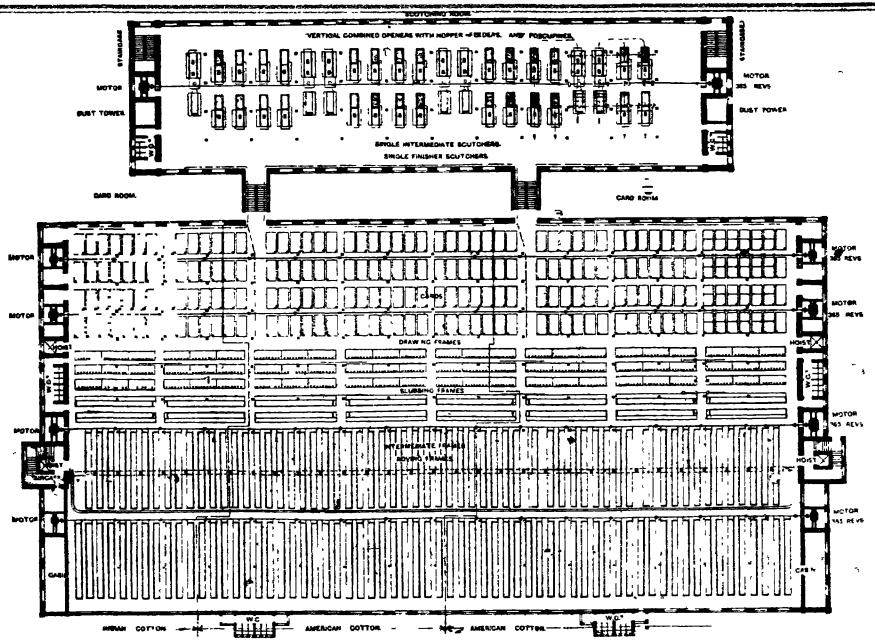


PLAN OF CARD ROOM FOR A MILL OF 97,300 SPINDLES.

40's to 70's Twist and Weft.

Particulars of Mill containing 97,300 spindles.

1	Hopper Bale Breaker, with lattices.					
2	Double Openers with Hopper Feeders					
4	Single Scutchers.					
100	Carding Engines, 50 in. × 38 in					
9	Drawing Frames, each 3 heads of 8 deliveries,				16 in.	roller
3	,, ,, ,, 2 ,, ,, 8 ,,				16 in	,,
8	Slubbing ,,	120	spindles,	8 in.	space.	
19	Intermediate ,,	148	,,	6½ in.	,,	
52	Jack ,,	226	,,	4½ in.	,,	
1st	Spinning Room—20 Mules,	1,366	Spindles,	1⅛ in	space	=27,320
2nd	,, ,, 10 ,,	1,378	,,	1⅛ in.	,,	=13,780
	10 ,,	1,124	,,	1⅛ in.	,,	=11,240
3rd	,, ,, 20 ,,	1,124	,,	1⅛ in	,,	=22,480
4th	,, ,, 20 ,,	1,124	,,	1⅛ in.	,,	=22,480
					Total	97,300 Spindles.

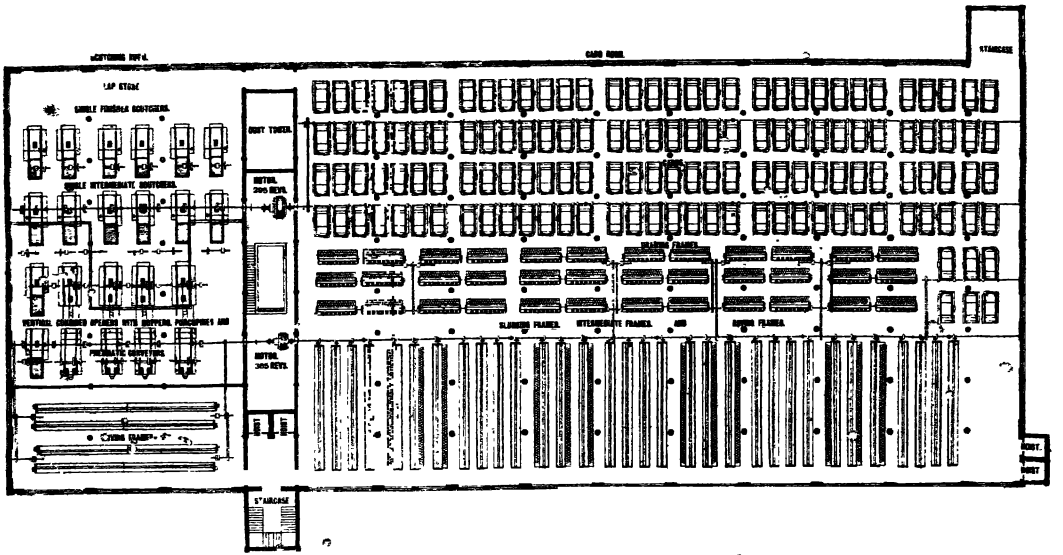


PLAN OF CARD ROOM OF A MILL OF 97,996 SPINDLES.

Spinning Mill containing 76,076 Ring Spindles and 21,920 Mule Spindles,

for spinning 16's to 28's twist and weft, Indian and American Cotton.

2	Hopper Bale Breakers					
7	Vertical Openers combined with Hopper Feeder and Porcupine					
28	Single Scutchers.					
216	Cards 38 in. wide.					
24	Draw Frames, each 3 heads for 8 deliveries each					
18	Slubbers,	108 spindles each, 8 in space.				
38	Intermediate Frames,	132	,,	,,	$6\frac{1}{2}$ in.	,,
84	Roving ,,	164	,,	,,	$5\frac{1}{4}$ in.	,,
112	Twist Ring ,,	456	,,	,,	$2\frac{5}{8}$ in	,, =51,072 spindles.
47	Weft Ring ,,	532	,,	,,	$2\frac{1}{4}$ in.	,, =25,004 ,,
20	Self-Acting Mules,	1,096	,,	,,	$1\frac{3}{16}$ in	,, 21,920 ,,
						97,996

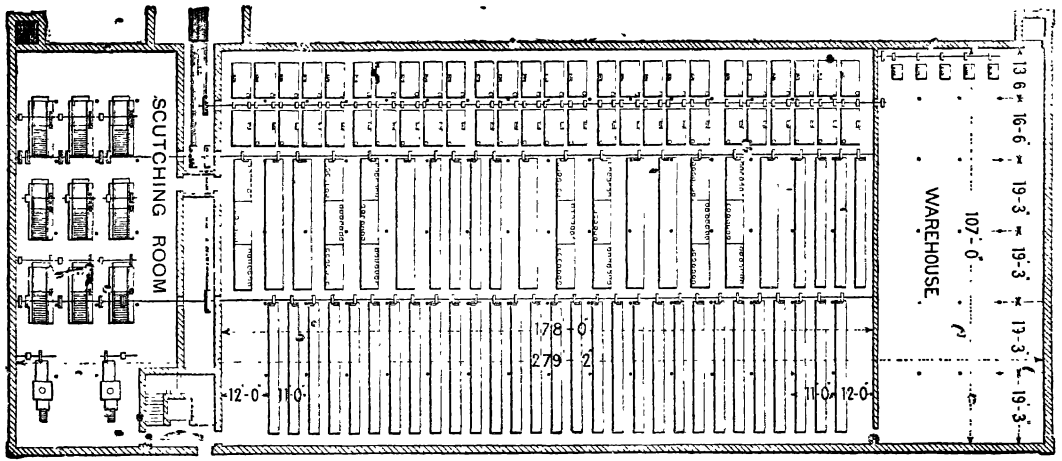


PLAN OF A CARD ROOM OF SPINNING MILL CONTAINING 40,864 SPINDLES.

Spinning Mill containing 18,400 Ring Spindles and 22,464 Mule Spindles,

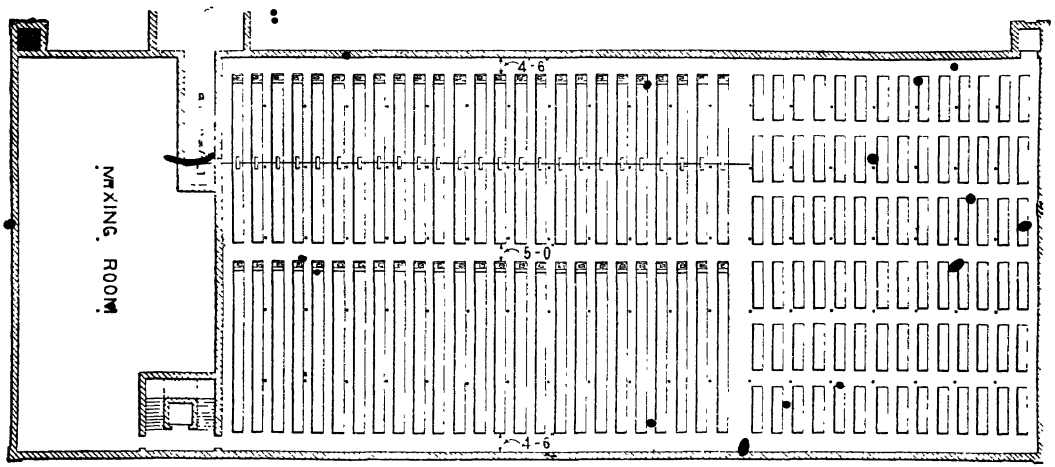
for spinning 12's to 18's twist and weft, Indian and American Cotton.

1	Roving Waste Opener					
1	Bale Breaker with mixing lattices.					
1	Single Vertical Opener with mixing lattices					
3	Hopper Feeders.					
3	Vertical Openers combined with Hopper Feeders, Porcupines, and Pneumatic Conveyors.					
12	Single Scutchers to make 40 in. laps.					
134	Cards, 40 in. wide.					
18	Draw Frames, each of 2 heads of 8 deliveries each.					
12	Slubbing Frames,	96	spindles each,	9½	in space	
16	Intermediate Frames,	140	,, ,,	6½	in. ,,	
24	Roving Frames,	252	,, ,,	5⅛	in. ,,	(double driven).
4	Roving Frames,	176	,, ,,	5⅛	in. ,,	
40	Twist Ring Frames,	460	,, ,,	2⅜	in. ,,	=18,400 spindles.
6	Twist Self-acting Mules,	776	,, ,,	1¾	in. ,,	=4,656 ,,
4	,, ,, ,,	904	,, ,,	1¾	in. ,,	=3,616 ,,
4	,, ,, ,,	884	,, ,,	1½	in. ,,	=3,536 ,,
4	Weft Self-acting Mules,	1,080	,, ,,	1¼	in ,,	=4,320 ,,
6	,, ,, ,,	1,056	,, ,,	1¼	in. ,,	=6,336 ,,
						40,864



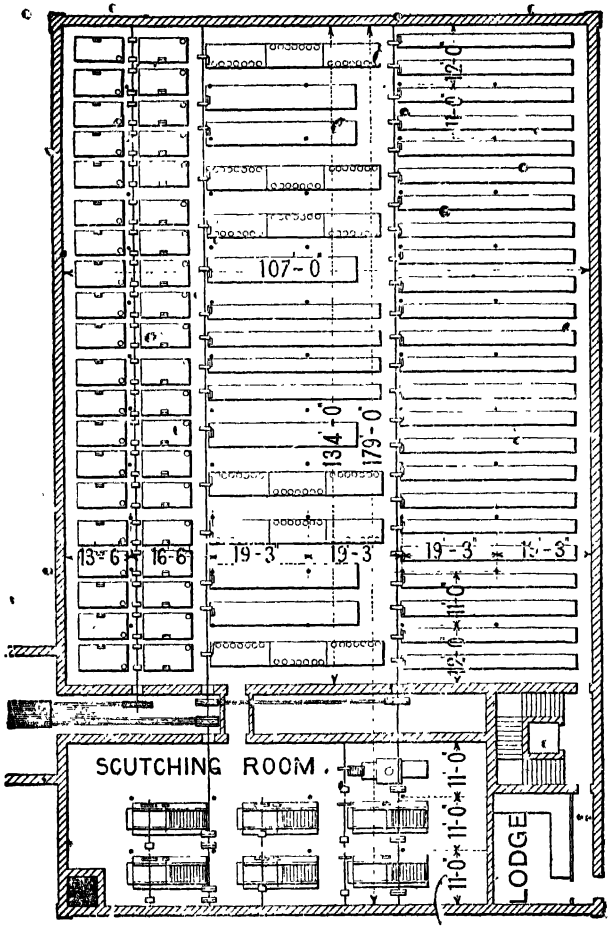
CARD ROOM OF INDIAN MILL. Containing 20,000 Ring Spinning Spindles, Spinning No 20's.

2 Single Vertical Openers, with Porcupine Feeder
9 ,, Scutchers
52 Carding Engines.
7 Draw Frames, each 3 heads of 7 deliveries.
7 Slubbers, 78 spindles each, 10 in. space.
8 Intermediates, 120 spindles each, 6½ in space.
4 ,, 122 ,, ,, 6½ in. ,,
25 Rovers, 160 ,, ,, 5 in ,,
3 Bundling Presses.



SPINNING ROOM OF INDIAN MILL.

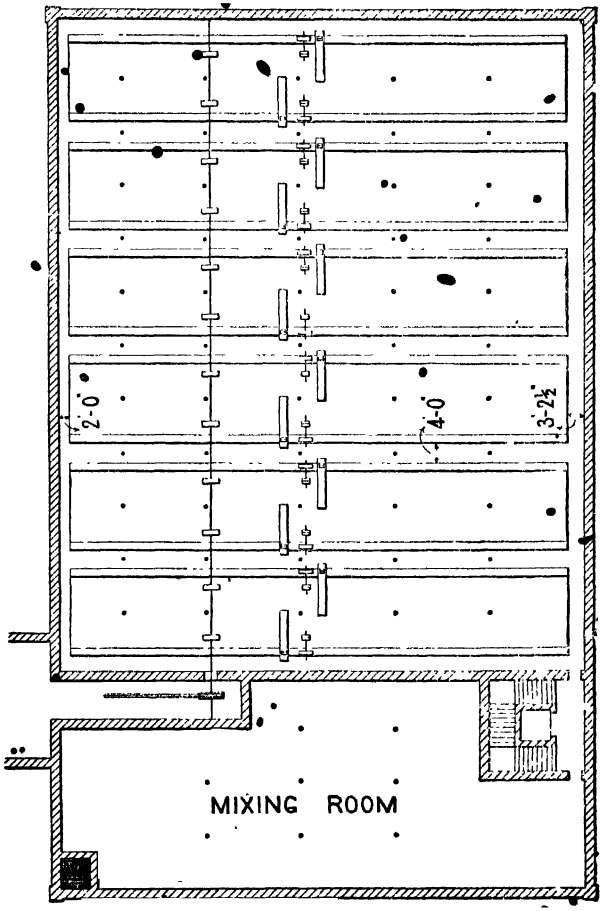
50 Ring Spinning Frames, each 400 spindles, $2\frac{3}{5}$ in. space = 20,000 spindles.
84 Hand Reels of 40 hanks each



CARD ROOM OF INDIAN MILL OF 3½ STOREYS.

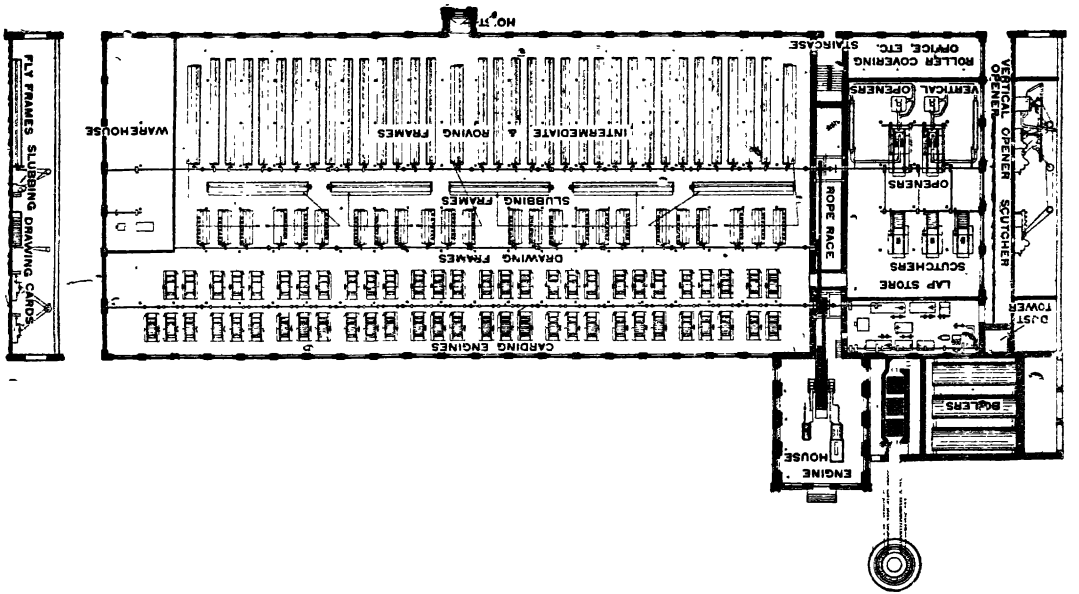
Containing 20,064 Mule Spindles, Spinning No. 20's.

1	Single Vertical Opener, with Porcupine Feeder.			
6	,, Scutchers.			
40	Carding Engines.			
6	Draw Frames, each	3 heads of 7 deliveries.		
6	Slubbers, ,,	66 spindles,	10 in.	space.
4	Intermediates, ,,	120 ,,	6½ in.	,,
5	,, ,,	122 ,,	6½ in.	,,
19	Rovers, ,,	160 ,,	5 in.	,,



1st SPINNING ROOM OF INDIAN MILL.

Each Spinning Room contains 12 Mules of 836 spindles each, 1⅜ in. space = 20,064 spindles.



CHINESE MILL, containing 14,800 Ring Spindles.

PARTICULARS OF MILL CONTAINING 14,800 RING SPINDLES.

CHINA.

Average 14's Counts.

1 Willow, with self-acting grid and delivery, 56 in. wide.
1 Roving Waste Opener, 25 in. wide

Patent Pneumatic Cotton-Mixing Plant.

1 Hopper Bale Breaker, 36 in wide, with delivery mouth-piece.
2 Delivery Boxes.
1 Collector and Delivery Box
1 Exhaust Fan
1 Control Stand
2 Swivel Guide Plates, 3 mixings

Blowing Room.

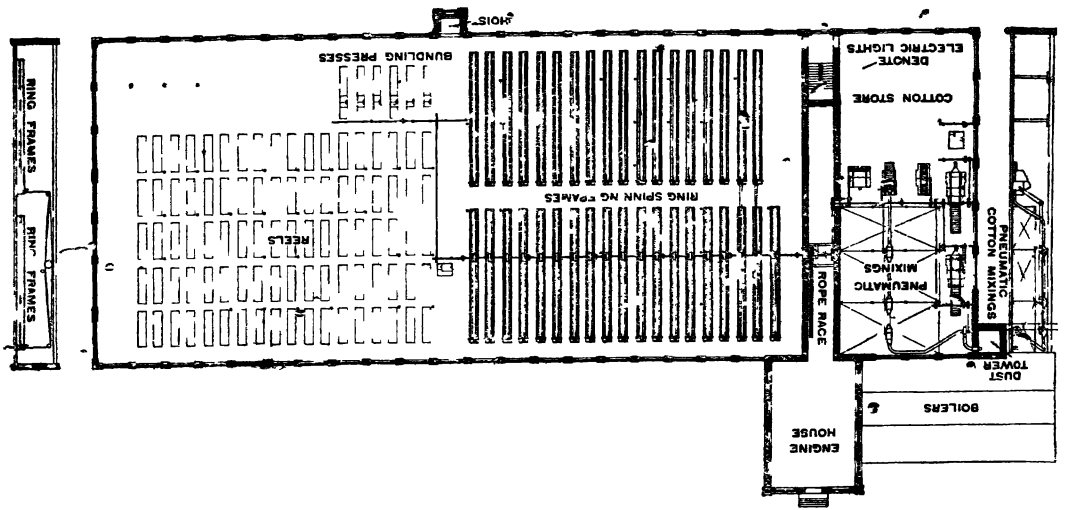
2 Hopper Feeders with Porcupine, 37 in wide, 10 feet of feed lattice.
2 Single Vertical Openers, with by-pass arrangement.
2 Dust Trunks, with travelling lattice
2 Horizontal Exhaust Openers, 38 in. laps
3 Single Scutchers, Finishers 38 in. laps

Card Room.

57 Cards, 50 in. × 38 in. laps, 26 in. doffers.
24 Drawing Frames, 1 head, 7 deliveries, 17 in. roller.
8 Slubbing " 80 spindles, 10 in space, 10 in. lift.
11 Intermediate " 132 " 6½ in " 10 in. "
21 Roving " 168 " 5⅝ in. " 7 in. "

Mechanics' Shop.

1 10 in. Lathe
1 6 in "
1 Grinding Stone
1 Smith's Hearth and Anvil.
1 Drilling Machine
1 10 in Shaper
1 Wheel Cutter.
1 Circular Saw.



CHINESE MILL contain n_ r So Ri g Spind e

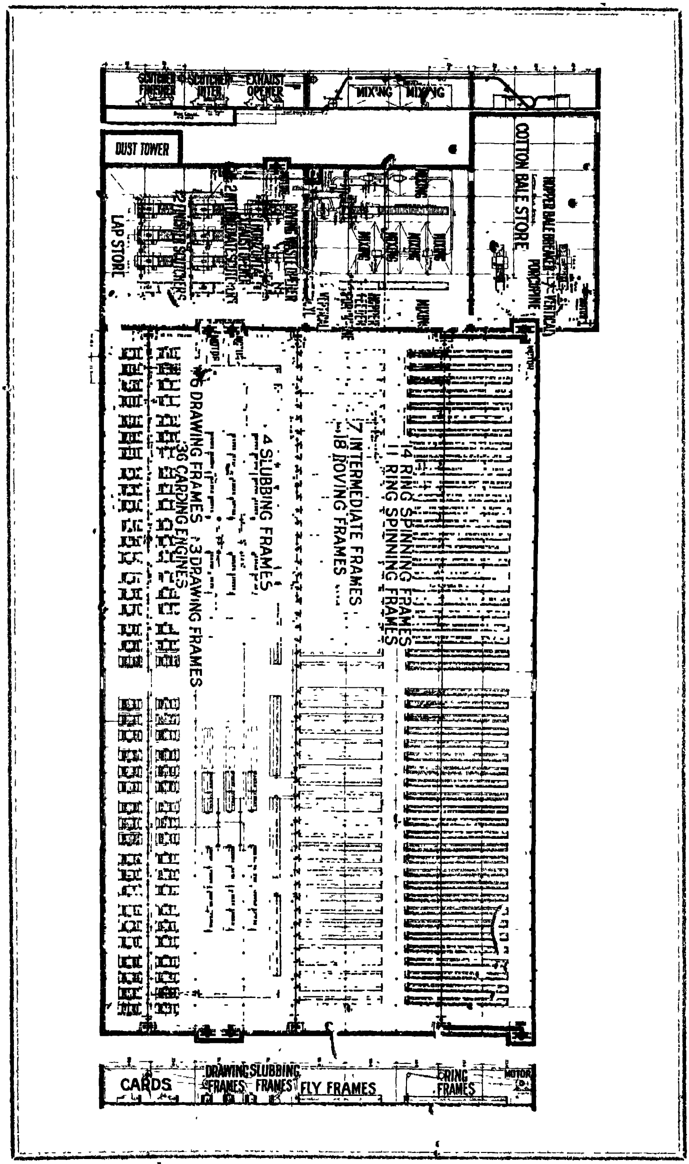
PARTICULARS OF MILL CONTAINING 14,800 RING SPINDLES.

CHINA.

Average 14's Counts.

Spinning Room.

37 Ring Frames, 400 spindles, $2\frac{5}{8}$ in. space, 5 in. lift.
90 Single Hand Reels, 40 hks., $3\frac{1}{2}$ in. gauge.
6 Bundling Presses, 10 lb. bundles.
1 Banding Machine, 16 spls.
1 Winder for ditto.
1 Hydraulic Baling Press, for 40-10 lb. bundles.
1 Pump for ditto.
1 Thread Extractor.


SCUTCHER FINISHER
SCUTCHER INTER
EXHAUST OPENER
MIXING
MIXING
DUST TOWER
COTTON BALE STORE
HOPPER BALE BREAKER
PORCUPINE
LAP STORE
2 FINISHER SCUTCHERS
MIXING
MIXING
MIXING
MIXING
MIXING
6 DRAWING FRAMES
36 CARDING ENGINES
3 DRAWING FRAMES
4 SLUBBING FRAMES
7 INTERMEDIATE FRAMES
18 ROVING FRAMES
14 RING SPINNING FRAMES
11 RING SPINNING FRAMES
CARDS
DRAWING FRAMES
SLUBBING FRAMES
FLY FRAMES
RING FRAMES
MOTOR

Particulars of Mill containing 20,608 Ring Spindles.

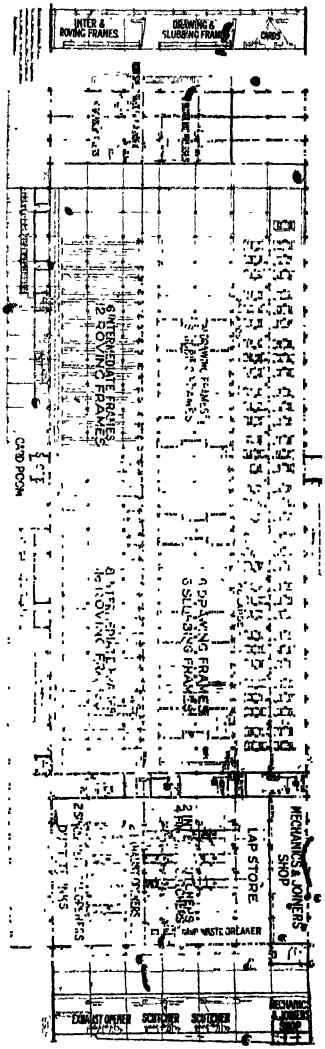
Japan.

Average 20's Counts

---

2 Hopper Bale Breakers, 36 in. wide
2 Porcupine Cylinders, 37 in wide
2 Vertical Cylinders
1 Exhaust Fan, 21 in. blade
5 Patent Pneumatic Delivery Boxes for Cotton Mixings.
2 Horizontal Exhaust Openers, 46 in. lap.
2 Hopper Feeders, 37 in. wide, with automatic feed lattice
2 Porcupine Cylinders, 37 in wide
2 Vertical Cylinders with by-pass arrangement.
2 Dust Trunks with Travelling Lattice.
8 Single Scutchers, 4 Intermediate, 46 in. lap, 4 Finisher, 45 in lap
78 Carding Engines, 50 in. 45 in., 26 in Doffer.
18 Drawing Frames, 2 heads of 5 deliveries, 16 in roller.
8 Slubbing Frames, 80 Spindles, 10 in. space, 10 in. lift.

14	Intermediate	,,	120	,,	6½ in	,,	10 in	,,	
36	Roving	,,	156	,,	5¼ in.	,,	7 in.	,,	
28	Twist Ring	,,	384	,,	2⅝ in	,,	5 in	,,	= 10,752 Spindles.
22	Weft	,,	,, 118	,,	2¼ in	,,	5 in	,,	= 9,856 ,,
									20,608


INTER & ROVING FRAMES
DRAWING & SLUBBING FRAMES
CARDS
INTERMEDIATE FRAMES
12 ROVING FRAMES
CARD ROOM
DRAWING FRAMES
SLUBBING FRAMES
LAP STORE
MECHANICS & JOINERS SHOP
CARD WASTE BREAKER
EXHAUST SPINNER
SCUTCHER
SCUTCHER
MECHANICS & JOINERS SHOP

PARTICULARS OF MILL CONTAINING 20,120 RING SPINDLES.

CHINA.

Counts average 14's and 40's.

BLOWING ROOM

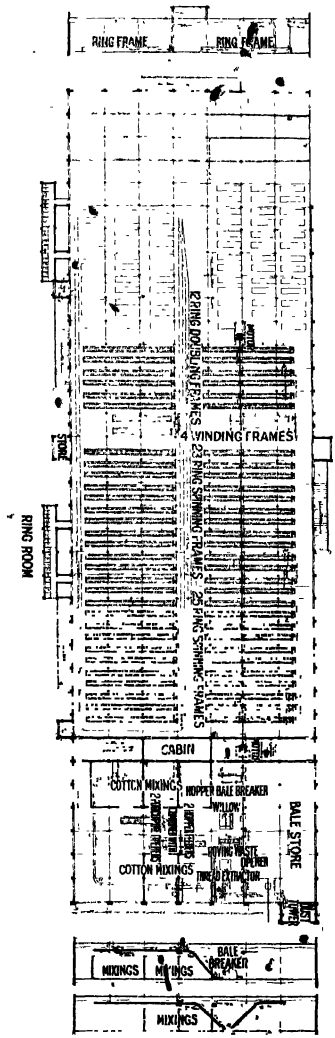
1 Hard Waste Breaker, 1 Cylinder
2 Single Vertical Openers with by-pass arrangement
2 Dust Trunks with travelling lattices.
2 Horizontal Exhaust Openers 40 in laps.
6 Single Scutchers 40 in. laps, 2 Intermediate, 4 Finisher.

CARD ROOM.

65 Cards, 50 in × 40 in. laps, 26 in. doffers
10 Drawing Frames, 3 heads of 7 deliveries, 17 in. Roller.
10 Slubbing Frames, 80 spindles, 10 in. space, 10 in. lift.
14 Intermediate Frames, 132 spindles, 6½ in. space, 10 in. lift.
28 Roving Frames, 168 Spindles, 5½ in. space, 10 in. lift.

WAREHOUSE

5 Bundling Presses, 10 lb bundles.
1 High Speed Braider and Winder.
1 Hydraulic Baling Press for 40/10 lb. bundles.
1 Pump for ditto.


RING FRAME
RING FRAME
SPINNING FRAMES
4 WINDING FRAMES
RING ROOM
STORE
CABIN
COTTON MIXINGS
HOPPER BALE BREAKER
WILLOW
BALE STORE
MOVING WASTE OPENER
COTTON MIXINGS
THREAD EXTRACTOR
MIXINGS
MIXINGS
BALE BREAKER
MIXINGS

Particulars of Mill containing 20,120 Ring Spindles.

CHINA..

Counts average 14's and 40's

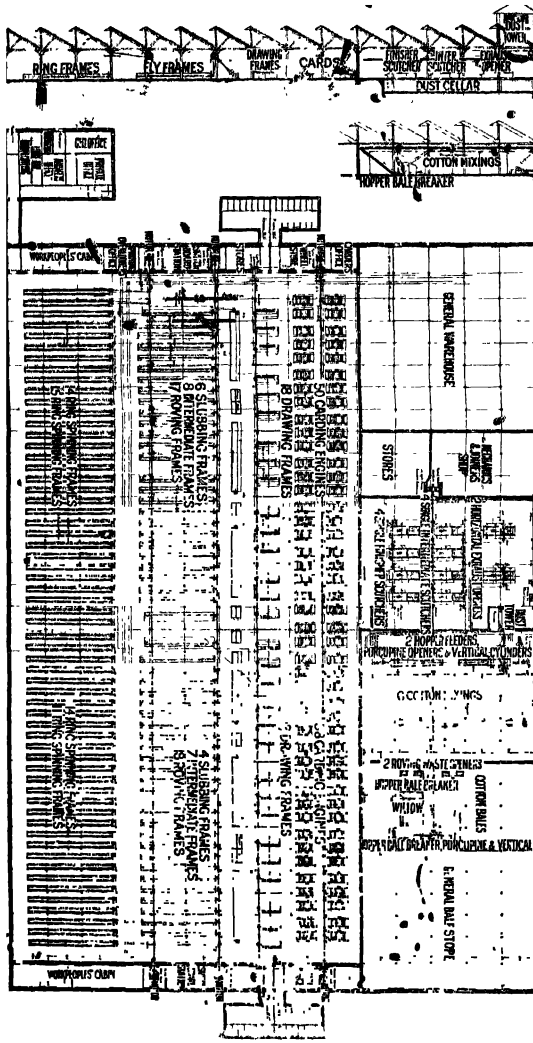
MIXING ROOM.

1 Thread Extractor
1 Roving Waste Opener, 25in wide.
1 Willow with self-acting grid and delivery, 56in wide.
1 Hopper Bale Breaker, 36in wide
3 Patent Pneumatic Delivery Boxes for Cotton Mixings
1 Exhaust Fan, 21in blade.
2 Hopper Feeders with Porcupine Openers, 37in wide, with automatic feed lattice

RING ROOM.

		Spindles.	Counts.
25	Ring Frames, 400 Spindles, 2¾in space, 5in 1ft,	10,000	Av 14's
23	" " 440 " 2⅝in " 5in. "	10,120	Av 40's
		20,120	

69 Single Hand Reels, 40 Hank
12 Ring Doublers, 120 Spindles, 2½in. space, 4½in lift
4 Winding Frames, 100 Drums, 5 Traverse


RING FRAMES
FLY FRAMES
DRAWING FRAMES
CARDS
FINISHER SCUTCHER
WASTE SCUTCHER
DUST DOWEL
DUST CELLAR
COTTON MIXINGS
HOPPER BALE BREAKER
OFFICE
WORKPEOPLE'S CABIN
GENERAL WAREHOUSE
STORES
2 HOPPER FEEDERS, PORCUPINE OPENERS & VERTICAL CYLINDERS
2 ROVING WASTE STRIPPERS
HOPPER BALE BREAKER
WILLOW
COTTON BALES
GENERAL BALE STORE

Particulars of Mill containing 22,400 Ring Spindles.

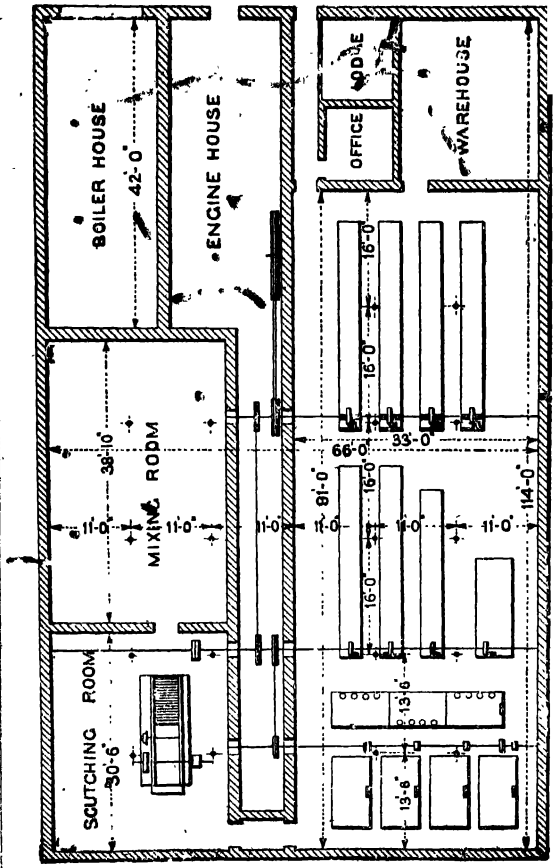
Japan.

Counts average 16's and 20's

---

1 Willow with self-acting grid and delivery 56 in. wide.
2 Roving Waste Openers, 25 in. wide
2 Hopper Bale Breakers, 36 in. wide.
1 Porcupine Cylinder 37 in. wide.
1 Vertical Cylinder
1 Exhaust Fan, 21 in. Blade.
3 Patent Pneumatic Delivery Boxes for Cotton Mixings
2 Horizontal Exhaust Openers, 46 in lap.
2 Hopper Feeders, 37 in. wide, with automatic feed lattice
2 Porcupine Cylinders, 37 in wide
2 Vertical Cylinders with by-pass arrangement.
2 Dust Trunks with Travelling Lattice
8 Single Scutchers { 4 Intermediates, 46 in Lap. / 4 Finishers, 45 in. Lap
86 Carding Engines, 50 in × 15 in., 26 in. Doffer.
30 Draw Frames, 1 head of 7 deliveries, 16 in roller.
10 Slubbing Frames, 80 spindles, 10 in space, 10 in. lift.

15 Intermediate	,,	132	,,	6¼ in.	,,	10 in.	,,	
35 Roving	,,	168	,,	05⅛ in.	,,	7 in	,,	
28 Twist Ring	,,	384	,,	2⅝ in.	,,	5 in	,,	— 10,752 Spindles
26 Weft	,,	448	,,	2¼ in.	,,	5 in.	,,	— 11,648 ,,
								22,400 ,,

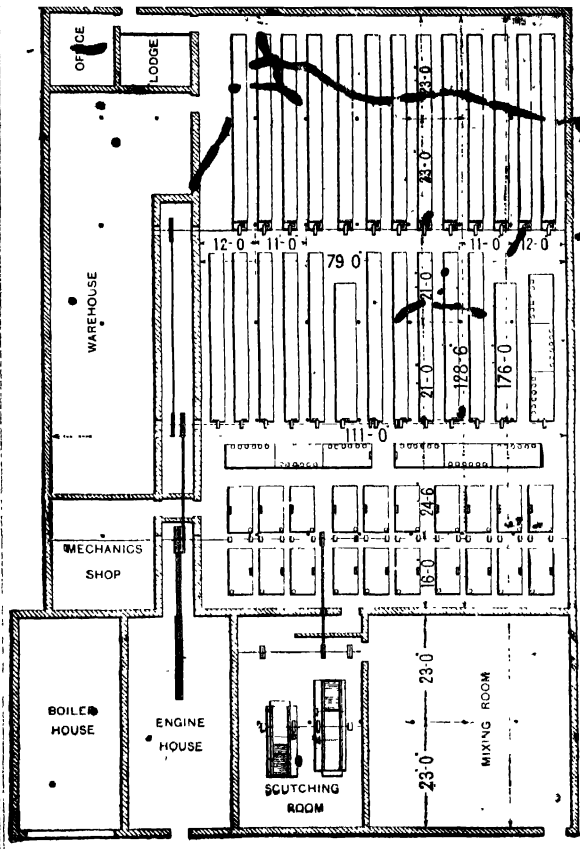


BRAZILIAN MILL (SHED).

Containing 992 Ring Spinning Spindles, Spinning No. 14's Twist and Weft.

1 Single Scutcher—the cotton would be passed through three times.
4 Carding Engines.
1 Draw Frame, 3 heads of 4 deliveries
1 Slubber, 32 spindles, 8 in. space.
1 Intermediate, 74 " 6½ in. "
2 Rovers, each 112 " 5 in. "
2 Twist Ring Frames, 228 spindles each, 2⅜ in. space = 456 spindles.
2 Weft " " 268 " " 2¼ in. " = 536 "

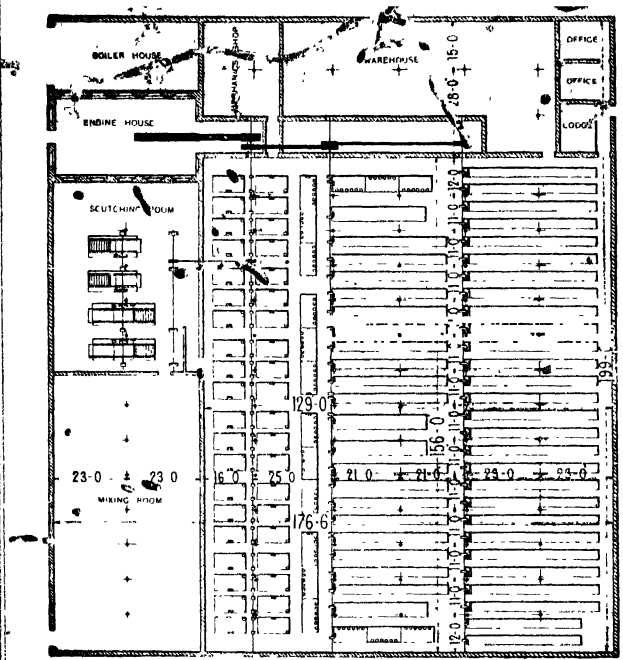
992



BRAZILIAN MILL (SHED).

Containing 4,988 Ring Spinning Spindles, Spinning No. 14's Twist and Weft.

1	Double Opener, with lap part				
1	Single Scutcher.				
20	Carding Engines.				
3	Draw Frames, each 3 heads of 6 deliveries.				
2	Slubbers,	80 spindles each,	8 in. space.		
3	Intermediates, 124	,, ,,	6½ in. ,,		
7	Rovers 160	,, ,,	5 in. ,,		
7	Twist Ring Frames, 350	spindles each,	2⅜ in. space	= 2,492	spindles.
6	Weft ,, ,,	416 ,,	,, 2¼ in. ,,	= 2,496	,,
				4,988	,,



BRAZILIAN MILL (SHED) Containing 9,976 Ring Spinning Spindles, Spinning No. 14's Twist and Weft.

2 Double Openers, with lap parts
2 Single Scutchers.
40 Carding Engines.
6 Draw Frames, each 8 heads of 6 deliveries.
6 Slubbers, 80 spindles each, 8 in. space.
6 Intermediates, 124 ,, ,, 6½ in. ,,
14 Rovers, 160 ,, ,, 5 in. ,,
14 Twist Ring Frames, 356 spindles each, 2⅜ in. gauge = 4,984 spindles.
12 Weft ,, ,, 416 ,, ,, 2¼ in. ,, = 4,992 ,,

9,976 ,,

ESTABLISHED 1790.

Telegraphic Address :— "DOBSONS, BOLTON."
Codes used :—A B C, Western Union, and [illegible]
National Telephone No. 301.

DOBSON & BARLOW LIMITED.

BOLTON.

MAKERS OF THE FOLLOWING—

- Hopper Bale Breakers and Mixing Lattices.
- Hopper Feeders.
- Vertical and Horizontal Openers.
- Scutchers.
- Carding Engines.
- Improved Grinding Machines.
- Improved Grinding Rollers.
- Stripping and Burnishing Brushes.
- Sliver Lap Machines.
- Derby Doublers.
- Draw and Lap Machines combined.
- Combing Machines.
- Drawing Frames.
- Fly Frames.
- Self-acting Mules.
- Self-acting Twiners.
- Self-acting Billeys.
- Ring or Flier Throstle Frames.
- Ring or Flier Doubling Frames.
- Reels.
- Winding Frame, with or without Quick Traverse Motion.
- Gassing Frames do. do.
- Banding Machines.
- Bundling Presses.

ALSO MAKERS OF

Machinery for Wool, Worsted, Silk, and Waste Yarns, and of many other Machines,
Tools. Spindles. Fliers. Rollers. etc.. etc.